

**Management challenges of an Information and  
Communication Technology network in rural schools**

by

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**A thesis submitted in fulfilment for the degree of**

**PHILOSOPHIAE DOCTOR**

in the

**Department of Science, Mathematics and Technology  
Education**

**Faculty of Education  
University of Pretoria**

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**March 2015**

### **Declaration of originality**

I declare that the thesis, which I hereby submit for the degree PhD (CiE) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.



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Management challenges of an Information and Communication  
Technology network in rural schools

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Education Management and Policy Studies

8 September 2014

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## **Acknowledgements**

I wish to thank my supervisor, Prof. F.J. Nieuwenhuis, for his invaluable and consistent advice and support. Without his constant guidance, this study would not have been possible.

In addition, I thank my family for their encouragement and interest in my progress and my colleagues and friends for being an important source of motivation.

Thank you to Elaine Holliday, my proofreader. You did a sterling job!

## Summary

Information Communication Technologies (ICTs) play an important role in reforming education. The purpose of the study was to describe the management challenges and the type of management approach that developed during the implementation of an ICT network, and what possible contribution the lessons learnt from this case study could make towards management theory.

In April 2008 an interactive whiteboard (IWB) network was established in an Mpumalanga town, with one of the province's foremost schools being partnered with five disadvantaged schools. The management challenges in this network required an approach that deviated from the traditional line-function approach. This study explores the paradigm shift from a mechanistic management view to an organic or distributed model and matrix design.

This is a qualitative descriptive case study. I described the reality through the eyes of the participants and the context of the study from my own specific perspective. The intervention established the project as a case: a small geographical area and a small number of individuals chosen. I did a content analysis of my semi-structured interviews, documents and field notes. I arranged the data in different codes and families in Atlas.ti and described the patterns in the data.

Findings indicated a difference between the management challenges of the rural schools and the leading school. The management approach was identified as a systems management approach. A balanced matrix management model developed in the leading school, but in the rural schools teachers still reported hierarchically to their HODs and principals. They also reported horizontally to the project manager, administrative officer and HODs of the leading school in their subject groups.

This study contributes to current management theory through the description of the matrix model that developed in the leading school, as well as the discussion of the management procedures in the rural schools, and the special roles of the SGBs, principals, project manager, administrative officer and HODs.

**Keywords:** disadvantaged schools, distributed leadership, Information Communication Technologies (ICTs), interactive whiteboards (IWBs), management challenges, matrix model, organic organisation, qualitative descriptive case study, rural schools, systems management approach

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## List of acronyms

<b>DoBE</b>	Department of Basic Education
<b>DoE</b>	Department of Education
<b>HOD</b>	Head of Department
<b>ICT</b>	Information Communication Technology
<b>ICT4D</b>	ICT for Development
<b>IWB</b>	Interactive whiteboard
<b>LLITUP</b>	Living Lab for Innovative Teaching Research at the University of Pretoria
<b>LS</b>	Leading school
<b>MDoE</b>	Mpumalanga Department of Education
<b>PM</b>	Project manager
<b>SASA</b>	South African Schools Act
<b>SBM</b>	School based management
<b>SGB</b>	School governing body
<b>SLL</b>	Siyakhula Living Lab
<b>SMT</b>	School management team

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## Chapter 1: An overview of the study

### 1.1 Introduction

Information and Communications Technology (ICT) is enhancing our abilities to think, learn and communicate creatively and logically. It is a means by which we can access vast amounts of information and it helps us to establish contact with experts in every field (Imison & Taylor, 2001). Technology integration is the effective use of technology inside the classroom to better facilitate learning and prepare learners for the digital era. This can include anything from regular computer use to the use of technology as a means of presentation, such as smart boards, digital projectors and electronic textbooks (Frances, 2012). Because of the potential power of ICT, its possibilities and application in education have been widely researched and, as new possibilities emerge, the boundaries of traditional teaching and learning are being constantly extended (Imison & Taylor, 2001). ICT has become so important and valued in our society, that it dictates the way we communicate, socialise, organise, plan, interact, behave, work and live. It affects all spheres of our lives and has become an indispensable tool to function in modern society (Anderson, 2010). The on-going infusion of ICTs in schools, driven by the belief that ICTs can play an important part in reforming education and advancing educational goals, has placed pressure on school management teams to address reform and make ICT a priority in schools (Wong, Li, Choi, & Lee, 2008).

However, as early as the 1960s, (Beeby, 1966) asserted that education, much like religion, tends to venerate antiquity and is often slow to respond to the new possibilities and horizons being created through technology. While there have been many advances in the field of science, commerce, transportation and health care, education has remained largely unchanged (Hawkins, 2002). One reason why ICT has not made the inroads into classrooms that many expected it to make, may be the fear of technology, which is a powerful motivation for some teachers to resist change (Frances, 2012). Many people are nervous when using new technology to perform jobs they have previously done in other ways (Frances, 2012). Another important issue in the use of ICT in education is the considerable number of disparities between developed and developing countries (Jhurree, 2005). This means that they have vastly differing levels of implementation and integration of

ICTs in education and, if these issues are not addressed, they can increase the social, political and economic divide between schools and countries even further (Tinio, 2003). Some of the challenges that developing countries like South Africa, for example, are facing with regards to ICT implementation are the lack of infrastructure, resources and funds, which contribute to the widening of the digital divide between Africa and the developed world (DoE, 2004). Some of the personnel-related factors that affect the use of ICT include: low level of ICT literacy amongst teachers, insufficient ICT training, lack of confidence, inadequate technical support and a fear of using technology (Chigona & Chigona, 2010). Becta (2004) classifies the obstacles as teacher, school and system level barriers. Under teacher barriers they discuss lack of confidence and competence, teacher training and differentiated training programmes, resistance to change and negative attitudes. School barriers comprise lack of time and suitable educational software, old or poorly maintained hardware, absence of ICT infrastructure, accessibility and technical support and limited ICT access. System barriers include the rigid structure of education systems, traditional assessment and restrictive curricula.

Despite well-intended technology plans and government policies, ICT integration in South African schools is not realised and, as a result, classroom practice falls short of realising the potential of ICT to support teaching and learning (Leonard & Leonard, 2006). Teachers' reluctance to wholeheartedly embrace technology is often seen as reflecting their professional conservatism or lack of vision, but educational technology has often been designed without the close involvement of teachers and can therefore have little direct relationship with the aims of the curriculum (Mercer, Gillen, Kleine, Littleton, & Twiner, 2011). Pockets of innovation in South Africa do exist, for example the use of android technology in Doxa Deo School (Rademeyer, 2012), but one seldom expects to find innovative ideas in remote rural areas.

According to the DoE (2005, p. 8), international literature defines 'rural' as "a space where human settlement and infrastructure occupy only small patches of the landscape, and economic activity is dominated by primary production". In South Africa, this definition includes dense settlement created by apartheid-driven land resettlement policies. Here, colonialism and apartheid left an imprint on all aspects of rural life, with poverty being the most endemic characteristic of rural areas. Literature

on rural education emphasises circumstances of oppression, deprivation, disadvantage, and deficit (DoE, 2005), and the lack of basic infrastructure for things like water, electricity, roads and ICTs. The limited resources in rural areas also create the additional difficulty of attracting suitable teachers (Surty, 2011). People in rural areas are often stereotyped in ways that emphasise their powerlessness, but there is a need for investing in infrastructure and human capital in order to build knowledge and skills capacity, thereby preparing rural people for employment outside the field of primary agricultural production. The redress of education in rural areas requires integrated planning and implementation with the participation of local government, stakeholders and communities (DoE, 2005). The pockets of success already achieved indicate that it can be done, but it cannot be accomplished by the departments of education alone. 'Twinning' is an example of a partnership model for rural schools, where a well-resourced school in a rural area mentors an under-resourced school in their area. Where this happens, there is a remarkable change in the level of achievement (Surty, 2011).

The model that forms the foundation of my study is such a novel and enterprising concept that I, in a sense, stumbled across in my research endeavours. A number of rural schools formed a cluster using advanced ICT technology to disseminate knowledge centred in one institution to other more impoverished classroom situations. The model in itself was complex and it immediately raised questions as to how this complex situation was managed. To contextualise this it is important to understand the uniqueness of the model that was developed and implemented. This study concentrated on the managerial challenges to principals and other leaders when faced with accepting, introducing and managing new technology in their schools and, in particular, the use of different management theories, like matrix management, organic leadership, distributed leadership, and school based management.

In this chapter, the research setting is sketched and the importance of IWBs as the technology in this network is examined. The rationale, purpose, problem statement and research questions of the study are outlined, and the delimitation and significance of the study are discussed.

## 1.2 Situational context and research setting

In 2005, a foremost school in Mpumalanga, well-supplied with resources and with a reputation for academic success, bought two IWBs and a technology teacher started experimenting with the use of one in his class. He could connect to his friend in England and thought that, if this could be done, it should also be possible to link up with other schools in the region. The internet access in the local schools to do that, however, did not exist. It was thought that, if this could be developed, the knowledge and skills available in one school could be shared with other schools, thus benefitting the whole area. He shared his ideas and got his principal and a representative of the Mpumalanga Department of Education interested in his ideas. His school (hereafter referred to as the “leading school” due to the guiding role and responsibility that it takes in the project) took a decision to develop an ICT learning environment that would link their own school with schools having a history of poor academic performance due to disadvantages of a geographical and socio-economic nature. As a concept, it was unique to schools in South Africa. Realising the potential that such an initiative has, different sponsors came on board and provided funds. In April 2008, an interactive ICT-network was created, implementing smart boards (interactive whiteboards), with the leading school and three previously disadvantaged schools as partners. The main purpose was to reach out to rural schools in the area in order to improve the teaching of Science and Mathematics for grade 12 learners.

The University of Pretoria was requested to evaluate the pilot project, and two researchers from the University of Pretoria undertook an evaluation of the project for the Department of Education in Mpumalanga during the October 2008 “Holiday School” programme. A lot of positive developments were noted, such as learners being actively involved, going through notes, asking questions and enjoying using the smart boards themselves. In the interviews, learners from all schools reported being very happy with the use of the technology and it changed their feelings about the subjects concerned. They also thought the technology improved the quality of the teaching and that being taught by a teacher from another school added value to their learning experience (Nieuwenhuis & Mihai, 2008). Teachers agreed that it was good for learners to be taught by another teacher and to experience another way of doing the same thing and they thought it worthwhile to be able to evaluate themselves and

where they stand in comparison with other schools when writing the same assessment tests. Teachers felt that the project made a difference in the community since many teachers from the disadvantaged schools were not qualified to teach Science and Mathematics at a grade 10-12 level (Nieuwenhuis & Mihai, 2008).

However, risk factors were also identified. The learners from the leading school lost interest if a lot of questions were asked to which they already knew the answers. The initial training in the software was not adequate and teachers had to puzzle out many things on their own. Transmitting lessons during the first hour of the day, as was scheduled by the leading school, was problematic for the remote schools, whose learners often do not get to school on time due to their dependence on unreliable public transport. Miscommunication sometimes occurred in the planning and broadcasting times (Nieuwenhuis & Mihai, 2008).

In 2010, the project took a turn for the worse. The support from the Department of Education, that was vital to the success of the venture, dwindled and some of the sponsors withdrew their financial support as other priorities in the region superseded the importance of the project. The wireless network was also damaged by lightning and the leading school had to struggle to raise new sponsorships to finance the installation of a completely new system. Since 2011 the system has been running without any major problems and two more schools have been added to the project.

Three of the schools are rural (within a 50 km radius), while two schools are in the town (within a 10 km radius). These five schools are also connected to a central file server that is situated at the leading school. This file server contains all the Mathematics and Science resource materials such as lesson presentations, common tests and exams, recorded video lessons as well as lesson notes for the remote teachers and students. The lesson notes are printed the day before the actual transmission and then handed out on the day of the lesson. During each session, the presenter records the lesson and it is saved on the file server for the purpose of revision or it can be downloaded on a memory stick for the students to take home.

From a technical perspective, the learning system can be judged by the state-of-the-art equipment in the leading school, which makes it easier for the teachers to do their work on a higher level. The staffroom has a small IT centre equipped with an

interactive whiteboard, printers, scanners, internet connectivity and a wireless system. The printers are connected to all the computers, enabling the teachers to print learning materials from their classrooms. All of the classrooms in the leading school, as well as the few designated classrooms in the partner schools, are equipped with a desktop computer, broadband internet connection, digital camera systems for security purposes, digital sound system, a data projector, SMART interactive whiteboard, SMART document camera, the necessary software for each subject, and a SMART response system, (a handheld device looking like a cell phone) used by the students to give feedback so the teacher knows instantly who needs extra help. In addition, each classroom has a digital camera connected to a PC for the purpose of recording teacher or learner activity and transmitting it for display on an LCD screen adjacent to the interactive smart board in each of the linked schools, thus enabling all the learners to take an active part in the lesson. The schools are connected via a wireless network with Bridget conferencing software.

Many educational institutions try to equip schools with the latest technology to provide learners with better learning opportunities. This encourages teachers to use technologies such as computers and the internet and this process is called integration of information and communication technologies (ICT). A significant component of the ICT integration process has been widespread investment in the interactive whiteboard (Turel & Johnson, 2012). According to Kobus van Wyk, the programme director of the Khanya Education in Technology Project in the Western Cape, we have reached the "tipping point" in education with interactive whiteboards in South Africa, as incorporating them in lessons has enhanced teaching and learning in unexpected ways (News, 2011). This is very evident in the Mpumalanga project.

Teachers note the efficiency, flexibility and versatility, the opportunities to access countless multimedia sources, and the ability to manage classes easily as benefits of using IWBs (Glover & Miller, 2001). IWBs help learners to reason and think scientifically alongside their teachers and fellow learners (Beauchamp & Parkinson, 2005). Principals in this project emphasised that Science, in particular, benefitted through the use of the IWBs, as experiments became more accessible.

Many teachers effectively use whiteboards to appeal to multiple senses and learning styles and draw upon a variety of resources to suit different needs. Effective use of an IWB also encompasses a wide range of teaching strategies like teacher modelling, prompting, promoting questioning, managing class discussions, review of work in progress and whole class evaluation (Becta, 2004). Problem solving activities that incorporate an IWB are helping to promote learning and ensure continued motivation (Beauchamp & Parkinson, 2005).

The IWB gives learners the confidence to take part in lessons and they find it easier to express themselves using the whiteboard (Education & Training, 2011). The uniqueness of IWB technology lies in the intersection between technical and pedagogic activity, the making of meaning through interaction between teachers and learners and the physical interaction with the board (Smith, Higgins, Wall, & Miller, 2005). Teachers in this project reported that learners like to come to the front of the class to interact with the IWB.

Even though the advantages seem to be numerous, there are certain drawbacks. Schools cannot invest in an IWB package without giving serious consideration to the substantial cost involved (Becta, 2004). In this project the IWBs were mainly bought with sponsorship money, as well as through budgeting by school governing bodies (SGBs). In addition, teacher professional development is crucial. Teachers should not be left alone to experiment on their own after the initial hardware training. They need training in the most effective approaches and the appropriate software to take advantage of the technology. Some of the teachers in the project thought that the initial training was adequate, but others felt they required more training and raised it as an area of concern. It is also an aspect that carries financial implications, the responsibility for which is carried mainly by the leading school.

Becta (2004) finds that the developing of multimedia teaching materials is a significant addition to workload of educators. The use of IWBs and the expectations that the whiteboard engender in learners put pressure on teachers to constantly improve the presentation and content of lessons. This is also an aspect highlighted in the project. Even the expectations of the parents are much higher. In the most difficult teaching environments, it is the teacher's willingness to change that "makes-or-breaks" ICT use in schools (Slay, Sieborger, & Hodgkinson-Williams, 2007).

Whereas the agenda in decision-making had initially focused on the acquisition of ICT resources, there has been a shift towards how ICT should be used to support teaching and learning (Becta, 2007). The teachers in this project are definitely willing to take up the challenge of teaching and letting the learners learn in an IWB network. That is the main reason why this network is such a success story. In the leading school, champions of the system introduced new approaches and influenced their colleagues in their own and other schools by their example.

A provisional analysis of this project suggests that this initiative is an excellent model for other South African provinces to emulate, and that the project is extremely successful in bridging the urban-rural digital divide. The leading school's e-learning network uses 21st century technology to help disadvantaged schools to uplift their standard of teaching and learning and improve their results. The biggest challenge, however, relates to the overall management of the project that requires an approach different to the traditional school-based hierarchical models.

### **1.3 Rationale for the study**

Management of, and support from management, for ICT in schools in South Africa is lacking (Becta., 2005). The school management team needs to be trained, and some SMTs are not in favour of ICT integration in the curriculum. An example is the inability of some schools to purchase subject-specific software due to the lack of support from management (Maholwana-Sotashe, 2007).

I was part of the initial research conducted on the leading school's e-learning network and gained a keen interest in the project, as the learners, teachers and management members (unlike the afore-mentioned SMT's) were very positive about the project. From the outset, I was intrigued by the management challenges that required an approach that would deviate from the traditional line function approach. Each school retained its own management and governance structures, but had to create the wherewithal to manage the ICT network across traditional boundaries. Line function roles had to be adapted to cater for matrix type management roles, responsibilities and channels of communication and accounting. Since the project

has survived numerous setbacks, it offers an excellent opportunity to study the management challenges faced and solutions found.

#### **1.4 Problem statement**

The project that forms the basis of this study has survived the ebb and flow of numerous challenges, ranging from a lack of financing and technological glitches to the discontinuation of support from the Department. Nevertheless, it has remained strong and has been growing over time, which raises the question of what role has been played by the management of the project in ensuring the success and continuation of the initiative.

This study focused on how the management of each school handled the project across schools, what they thought about it, and how they succeeded in inspiring their teachers to be part of it. The software and hardware are in place and, although the system can suffer electricity interruptions and other breakdowns, the human factor is much more unpredictable and plays a major role in the success of a project like this. "Although there has been considerable improvement in delivering on IT projects in the past decade, successful ones are still considered the exception rather than the rule. Many factors have contributed to this dismal IT project track record, but none is more to blame than the lack of leadership" (Lang, 2007). Power relations and leadership issues are key elements in the success or failure of a project. Leadership is the exercise of power, (Michelson, 2001) therefore this project is looking at how leaders are using their power effectively to manage others.

#### **1.5 Statement of purpose**

The purpose of my research was to determine the key managerial challenges in implementing an ICT network at a cluster of schools and how managers handled possible conflict that developed between various role players in the network, and to uncover the reasons for such conflict, if it developed. This study is a continuation of the project I was involved in that was aimed at evaluating the pilot project when it got underway in 2008. At the time of the pilot project, I realised that a project of this nature requires a particular form of management that will be atypical of traditional management forms. The purpose of my research was as well to understand the type of management approach that developed during the implementation of the network

and to determine the influence of various role players, such as the project manager, school principals, SGBs, HODs, project coordinators and educators on the network. I wanted to examine the relationships between the different role players, with particular regard to how they used their power to influence others and to contribute to the success or failure of the network. I also wanted to discover the possible contribution that the lessons learnt from the case study could have on management theory with respect to the management of ICT in similar multi-school models. The purpose of my research was to answer the research questions that follow by examining the social setting of an interactive white board network in a rural area and the individuals that manage this setting.

## **1.6 Research questions**

### ***1.6.1 Main research question***

What are the key managerial challenges faced in implementing an inter-school ICT network?

### ***1.6.2 Sub research questions***

- a) What is/are the possible management model(s) that may be used in managing an ICT network involving numerous schools?
- b) What type of management approach developed during the implementation of the ICT network?
- c) What critical incidents occurred during the life span of the project that had an effect on the management of the project?
- d) What is the possible contribution that the lessons learnt from the case study could have towards management theory with respect to the management of ICT in similar multi-school models?

## **1.7 Research design**

This study was a descriptive qualitative case study. Qualitative approaches are based on a holistic "world view" and recognise that there is no single reality. Reality is based upon each individual's perceptions, which are prone to change over time. In addition, that which we know acquires meaning only within a given context and,

because perception varies individually, many different meanings are possible (Joubish, Khurram, Ahmed, Fatima, & Haider, 2011). According to the naturalistic paradigm, there are multiple interpretations of reality. The goal of researchers operating within this paradigm is to understand how individuals construct their own reality within their social context (Lincoln & Guba, 1985). Naturalistic inquiry wishes to achieve accurate description of the action in terms of knowing (Glaser, 2004). Descriptive research is restricted to factual registration and there is no quest for explanation. It does not aim at hypothesis formulation or development of a theory. The description of an object or process is realised from a specific perspective (Lans & Van der Voordt, 2002a). In case studies, the researcher systematically gathers information about a person, event or group to permit him or her to effectively understand how it functions (Berg, 2001). Case study research is descriptive research that involves describing events and conditions occurring in the present (Thomas, 2010).

### **1.8 Delimitation of the study**

This study is a single case study consisting of six high schools in Mpumalanga, South Africa, bound together into a cluster formed by their involvement in the same ICT network. The findings are therefore only relevant to this particular case, but the insights gained may be of value to other similar clusters. Experiences within the cluster studied brought to the fore particular challenges and exemplars of how these challenges were managed. The solutions found in the case study are particular to the specific case, but may provide information to people involved in similar ventures.

### **1.9 Significance of the study**

The information era, with its strong focus on the use of digital and electronic media, has created new challenges for schools as far as teaching and learning is concerned. While scientists and technologists are creating new innovative ways of communicating, educationists are left with the task of exploring new ways of using these technologies to improve the teaching and learning in schools. Linked to this are new management challenges that go beyond mere instructional leadership. This case study was chosen because it offered a unique opportunity to study a pioneering

initiative. Very little is known about management of ICT networks in education and therefore the study will make a significant contribution in this regard.

## **1.10 Outline of chapters**

### **Chapter 1**

This chapter serves as the introduction in which the orientation of the study is explained by discussing the situational context and research setting, rationale, problem statement and purpose statement of the study. The research questions are outlined, the research design summarised, and the delimitation and significance of the study discussed.

### **Chapter 2**

This chapter reviews the existing literature to develop an understanding of the difference between leadership and management and the role of the principal and functional and project leaders in a matrix. A general view of management development is given. The literature study elaborates on the theoretical framework used to scaffold the study, and concentrates on pertinent management theories, namely matrix management, organic leadership, distributed leadership and school based management.

### **Chapter 3**

This chapter is an in-depth discussion of the research design and methodology of the study. As part of the research design, the difference between epistemology and ontology is explored, after which attention is given to the naturalistic paradigm underlying the study. Being a qualitative descriptive case study, these terms are discussed with reference to the study. The research methodology is explained in detail, paying attention to the site and participants, data collection strategies and the method of data analysis. The chapter concludes with a discussion on the methodological norms and ethical issues.

## **Chapter 4**

This chapter discusses the research findings based on the collected data. The data analysis is presented based on direct quotes from semi-structured interviews which are grouped together in themes and families in Atlas.ti. Findings based on documents are also discussed. Some of the research questions are answered based on the data and literature.

## **Chapter 5**

This chapter discusses the conclusions of the study and answers the two of the research questions. The chapter concludes with implications for practice and recommendations for future research.

## **Chapter 2: The management of an ICT network**

### **2.1 Introduction**

Chapter 1 identified ICT as an increasingly powerful resource that needs to be researched in education (Imison & Taylor, 2001), but it was argued that it didn't make the inroads into classrooms to the degree that was expected. In spite of this fact, the background of the research identified a unique ICT network between six schools, of which three are rural, in Mpumalanga, South Africa, using IWBs to teach Mathematics and Science to senior learners. Many advantages of IWBs were discussed (Glover & Miller 2001; Beauchamp & Parkinson 2005; Becta 2004; Education & Training 2001; Smith et al. 2005), as well as certain drawbacks (Becta 2004), but it was concluded that the biggest challenge relates to the overall management of the project.

The previous chapter identified the rationale of the study as being the management challenges in the project which required a deviation from the traditional line function approach to leadership to the adoption of a matrix type of management. The purpose of the research was to determine the key managerial challenges in implementing an ICT network at a cluster of schools.

This study raises questions about the nature of those managerial challenges, possible management approaches to meet those challenges, the occurrence of critical incidents during the life span of the project that impacted on its management, and the possible contributions this case study can have on management theory. It emphasises the need for a new understanding of leadership beyond the bureaucratic managerial model and explores the paradigm shift from a mechanistic management view to an organic or distributed model, school-based management and a matrix design, which is the theoretical framework underpinning this study.

### **2.2 Leadership and management**

Leadership and management are not the same things, but they are linked and complementary. They are often used interchangeably in the literature. A manager's job is to plan, organise and coordinate, whereas a leader must inspire and motivate. Planning, budgeting, staffing, problem solving and measuring performance are management processes that keep the organisation going (Kotter, 2013).

Management facilitates production of commodities and services within budget and on time. Leadership is associated with finding and exploiting opportunities, buy-in, communication, motivation and inspiration, and it is about aligning people to a vision. It is not about attitudes but about behaviour (Kotter, 2013). Management involves effectively maintaining current organisational arrangements. Leadership is about influencing organisational members to achieve desirable goals and it involves initiating change (Spillane, 2009b). According to Fullan (2006, p. vii), “leadership is the art of getting a group of people to do something as a team because they individually believe it is the right thing to do”.

An important similarity between leadership and management is that good leadership always includes responsibility for managing. A big difference is that leadership always involves leading a group of people, while management is concerned with the responsibility for things such as IT and equipment, although many management roles also have people-management responsibilities (Scouller & Chapman, 2012). Botha (2013) is of the opinion that the main difference between management and leadership is that leadership relates to the mission of an organisation, but management involves getting things done. According to Nayar (2013), there are three tests to help ascertain whether you are leading or managing people. If you are counting value, you are a manager; leaders create value. Managers have subordinates, but leaders have followers; managers create circles of power and leaders circles of influence (Nayar, 2013).

Bennis (2009) regards management and leadership as having distinctly contrasting attributes. Leaders innovate and initiate, focus on people and inspire trust. They have their eye on the horizon and change the status quo. Managers administer and maintain the status quo, want immediacy, focus on systems and rely on control. Managers do things right; leaders do the right things (Bennis, 2009). Leadership and management need to be given equal priority in order for schools to achieve their objectives (Bush, 2006). Accountability and managerial responsibilities have been added to the principal’s role and, as these have been increased, so has the expectation to lead improvements in teaching and learning (Fullan, 2006). For an ICT network to be successful, effective leadership that is envisioning and inspirational is needed in addition to effective management in terms of achieving goals and objectives.

### 2.3 Strategic management in education

There is increasing recognition that schools are likely to be much more effective if they are well managed. Today schools are taking responsibility for many functions that were previously undertaken by national or regional government, like financial and staff management. Now that educational institutions have this responsibility, it is possible for leaders to adopt a strategic approach, integrating different aspects of management to achieve goals (Bush & Coleman, 2000). Management is not confined to the principal, however; strategic management is usually exercised by the principal in conjunction with the school governing body. Principals and members of SGBs are generally regarded as senior managers, while heads of departments or subject leaders are regarded as middle managers. Classroom teachers are thought of as managers of other staff, in that more experienced educators often perform in a mentoring or supervising capacity to junior teachers.

At the heart of educational management is formulation of the aims of an organisation. These can be decided by the principal together with senior colleagues, or undertaken by groups of staff. “A strategic approach to management requires an explicit sense of direction and purpose” (Bush & Coleman, 2000, p. 10), so the concept of vision has become increasingly important. A vision needs to be specific to a school and refers to a desirable future state of an organisation. It should clarify the direction to be taken by the institution and relates to the intended purposes of the school. It should inspire the organisational members with enthusiasm and not make them unwilling and resentful participants in the process (Bush & Coleman, 2000). A mission is regarded as a more specific expression of the values of an organisation and explains the overall philosophy. It is often captured in a short passage and is expected to be memorable and provide a guide to action (Bush & Coleman, 2000).

The management decides on cardinal matters such as the aims of the organisation and the use and implementation of resources (Botha, 2013). *Efficiency* refers to how productively resources are used to achieve a goal and *effectiveness* the appropriateness of the goals for the organisation. Effective managers choose organisational goals to pursue and utilise resources efficiently to achieve them (Jones & George, 2005). It is therefore the task of management to decide how best to use an organisation’s resources like its employees, information systems and financial assets, and those decisions impact directly on the socio-economic situation

of a society. An understanding of what and how managers do things is of importance in the understanding of how a society works (Jones & George, 2005).

Strategy is characterised by its holistic approach to management and an extended timescale. It is also value-driven and linked to the vision and mission. It is seen as a rational approach that assumes that leaders can acquire a measure of control over the ever-changing external environment. It helps managers to create order from chaos and to look through the immediate problems to an optimistic future. Strategy is an on-going, evolving and uncertain process (Bush & Coleman, 2000). Change may be externally imposed, or derived from internal forces; in either case it requires effective management. Leaders need to balance the demands of competing priorities and determine how to resource new initiatives and establish the climate and processes to forge new ideas (Bush & Coleman, 2000).

According to Levin and Schum (2012), school leaders need to address the following: their vision, mission, and goals; planning, decision-making, governance and culture; organisation and structure; curriculum and instructional strategies; learner expectations and responsibilities; assessment and evaluation; staff and financial resources; professional development and communication and relationships within the school community. Many leaders hope that technology will increase learner engagement, promote the development of 21<sup>st</sup> century skills, like information and media literacy, boost learner achievement, and develop a culture of collaboration, shared leadership and positive relationships with the community. In many places technology has been an effective catalyst for change (Levin & Schum, 2012).

Mintzberg (1989) argued that there are ten primary roles to categorise a manager's different functions. A manager's job is never static. At any given time, he or she will be carrying out a combination of these roles and hold different management positions over the span of his or her working life. The combination of roles varies for different managers, levels of organisation and over periods of time and managers do not give equal attention to each role (Mintzberg, 1989).

**Table 2.1: Mintzberg's ten manager's roles**

<b>Category</b>	<b>Roles</b>	<b>Description</b>
<b>Interpersonal</b> (provide information and ideas)	<b>1) Figurehead</b>  <b>2) Leader</b>  <b>3) Liaison</b>	1) Symbolic head, with social, ceremonial, and legal responsibilities. A source of inspiration to people. 2) Provide leadership to team, manage performance and responsibilities of everyone, responsible for staffing, training and associated duties. 3) Communicate with internal and external contacts. Networking for organisation.
<b>Informational</b> (involves processing information)	<b>4) Monitor</b>  <b>5) Disseminator</b>  <b>6) Spokesperson</b>	4) Monitor the team in terms of productivity and well-being. 5) Communicate useful information to the team, some factual, some involving interpretation and integration. 6) Represent the organisation, responsible for transmitting information about organisation and its goals.
<b>Decisional</b> (involves using information)	<b>7) Entrepreneur</b>  <b>8) Disturbance handler</b>  <b>9) Resource Allocator</b>  <b>10) Negotiator</b>	7) Creates and initiates improvement projects to bring about change. Have to solve problems, generate new ideas and implement them. 8) Need to take charge and mediate disputes, responsible for corrective action. 9) Allocating funding, assigning staff and other resources, makes and improves significant organisational decisions. 10) Need to take part in, and negotiate for team, department or organisation.

Source: (Mintzberg, 1989).

“The organisation expects from its managers three things. That they will:

- integrate its resources in the effective pursuit of its goals
- be the agents of effective change
- maintain and develop its resources” (Everard and Morris, 1996, p. 4).

Managerial activities concerned with the maintenance of resources are:

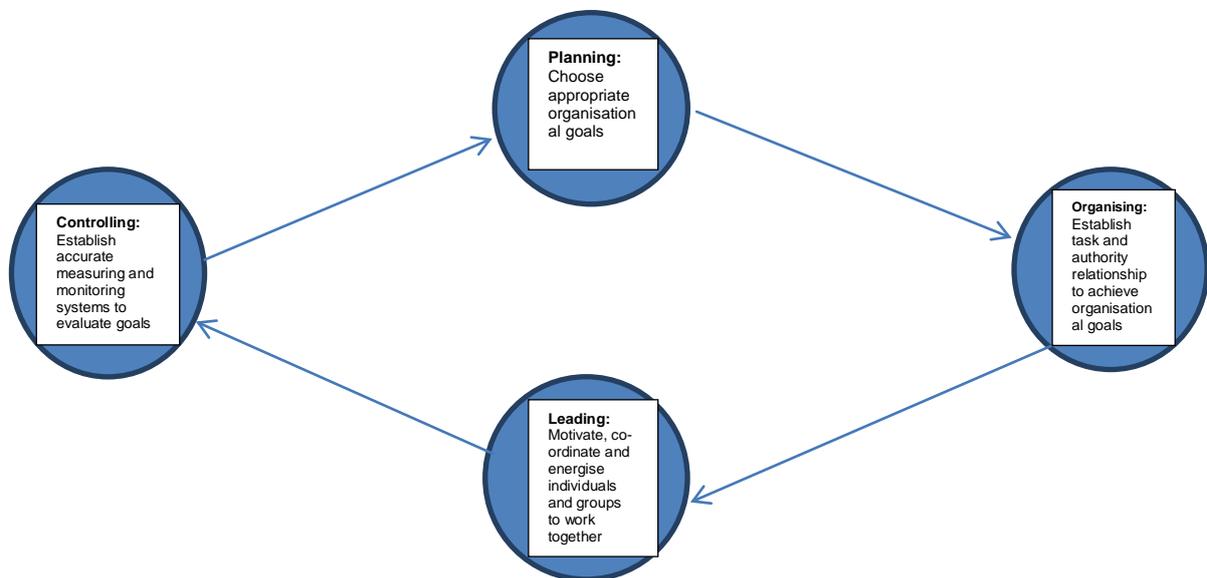
- Human: appraisal, counselling, career planning, training, project work
- Material: purchasing, stock control, asset management
- Financial: budgeting, fund-raising, cost control (Everard & Morris, 1996).

Managers also need conceptual, human and technical skills (Jones & George, 2005). “Conceptual skills are demonstrated in the ability to analyse and diagnose a situation and to distinguish between cause and effect. The ability to focus holistically on the organisational context enables managers to see beyond the immediate situation and consider choices, while keeping the organisation’s long-term goals in mind” (Jones & George, 2005, p. 18). “Human skills include the ability to understand, alter, lead and control the behaviour of others. The ability to co-ordinate, motivate and mould individuals into cohesive teams distinguishes effective from ineffective managers” (Jones & George, 2005, p. 19). Managers need a range of technical and IT skills to be effective; these encompass the job-specific knowledge and techniques required to perform an organisational role (Jones & George, 2005).

Botha (2013) defines a school, from a management perspective, as “resource focused and refers to how (process) the school (entity or institution) puts together (action) various human, financial, spatial, temporal and technological resources (things) to improve teaching and learning; that is, to achieve organisational goals” (Botha, 2013, p. 4). Every organisation has to carry out two types of tasks, namely the functional and managerial. Fulfilling a particular need in the community is the main or functional task. Whatever the management decides has a direct influence on the lives of the workers and the wider community. In order to carry out the functional task effectively, it has to perform a management task. Management can be defined as the methods employed to perform the functional task effectively, through the optimal use of available resources (Botha, 2013). Experience enables managers to develop the personal skills to put resources to their best use.

In fulfilling the objectives of the organisation, management’s task involves performing certain consecutive actions. These form a continuous cycle of planning, organising, leading, and controlling objectives and resources of the human, financial and physical variety. According to this theory, management is seen as a social action, because the actions concern the relationships between people. They are also inseparably bound and mutually dependent upon each other (Van der Westhuizen, 1995). Managers of all levels are responsible for performing these actions, and how well they perform them, determines how effective their organisations are (Jones & George, 2005).

**Figure 2.1: Four functions of management**



Source: (Jones & George, 2005).

Figure 2.1 illustrates how planning involves the prioritisation of organisational goals and courses of action. There are three steps: deciding 1) which goals the organisation pursues, 2) which actions to adopt to attain the goals, 3) how to allocate resources to accomplish the goals (Jones & George, 2005). Continuous planning results in a strategy, but which strategies to adopt are not necessarily clear, and managers take risks when they commit educational resources to pursue a strategy (Jones & George, 2005). The vision and mission and setting up of organisational goals are shared by all stakeholders. In a school, this has to do with the choice of learning content, the mode of knowledge transfer and technology in the classroom. Taking into consideration their capability and professional qualifications, the

identification of teachers responsible for knowledge transfer is done during the planning phase. This also involves identifying staff to control the budget needed for the school to meet its educational goals (Zengele, 2013) and ensuring that the staff has sufficient resources.

Organising entails grouping people in departments and the delegation of specific duties to qualified staff members. A structure of relationships is thus established that allows members to co-operate to achieve organisational goals (Jones & George, 2005). Power is decentralised from the top to the bottom (Zengele, 2013). Managers co-ordinate organisational resources and lay down the lines of authority between different individuals and groups (Jones & George, 2005). “The principal shows organisational skills by ensuring that all the management tasks are coordinated in the sense that a group of staff members reports to a common manager, and the reporting structure is such that the principal remains aware of all the management processes within the school” (Zengele, 2013, p. 21).

Leadership entails the use of power, vision, persuasion and communication skills (Jones & George, 2005). It relies heavily upon communication structures within the school in order to direct the organisation towards the achievement of its goals. Leaders should provide intrinsic and extrinsic motivation to staff and learners to co-own the organisational goals (Zengele, 2013).

In controlling, managers have to evaluate how well an organisation is achieving its goals and improve performance of individuals, departments and the organisation as a whole (Jones & George, 2005). Controlling has to do with the assessment and evaluation of tasks. Evaluation is done by means of supervising staff to ensure that objectives are met (Zengele, 2013). Managers must decide which goals to measure and this action also allows them to evaluate their own performance (Jones & George, 2005). The introduction of the CAPS curriculum has provided a turnaround in educational management as teachers attend training courses and return to schools to show how it is done in the classroom. The increased professionalism of teachers has made them take ownership of their classrooms and allowed principals to delegate the supervisory aspect to HODs. Teaching and learning activities are now directed by the needs of learners and not instructions from management (Zengele, 2013).

At the core of a manager's work, and weaving all the other managerial tasks together, is decision-making. A manager has to decide how people should be led to do what has to be done and make the right choices so that goals can be achieved effectively. Management by the teacher, head of department and principal is interrelated, but differs in the level and extent of execution. Every person who has to strive towards educational objectives in a leadership position and who must exercise control is occupied with managerial work (Van der Westhuizen, 1995).

"The present and future state of any organisation depends on its management. Its decisions make the difference between conflict and harmony, disruption and stability, prosperity and decline, success and failure, work satisfaction and dissatisfaction, cooperation and obstruction, and whether the organisation attains its goals or fails to do so" (Botha, 2013, p. 2).

#### **2.4 School leadership to maximize the impact of ICT integration**

Although few studies focus on the leadership for technology reform in schools, leadership is highlighted in the literature to be the key for successful ICT implementation (Seong & Ho, 2012). There is a limited amount of research on the school principal's relationship with computer technology and, without a thorough understanding of its capabilities, principals will not be able or ready to provide the leadership necessary in the restructuring of schools (Brockmeier, Sermon, & Hope, 2005). Yee (2000) confirms that "the ICT leadership of principals remains a topic that is not frequently considered when the theorists or practitioners discuss the unfulfilled promise of ICT in education" (Yee, 2000).

According to Imison and Taylor (2001), a key factor contributing towards the effectiveness of schools is good leadership by a preeminent professional, which is firm and purposeful, but with a participatory approach. Principals and the school community have the capacity to develop goals in a spirit of unity, consistency, collegiality and collaboration, thus making a shared vision of ICT integration possible (Tondeur, Van Keer, Van Braak, & Valcke, 2008).

Schiller (2011) argues that "principals direct budgets and professional development and have a key role as architect of a vision for teaching and learning in their schools and, through their interventions, they influence the role of ICT in this vision. They

have a considerable impact on the school's organisational and social culture and they are key facilitators in assisting teachers to improve teaching practices". Their interventions therefore have an impact on the teachers' implementation of ICT. Brockmeier, et al. (2005) affirms that a principal fulfils a visionary role when he or she understands how technology can be used in teaching and learning and establishes a context for technology in his/ her school. Some principals support ICT but do not have a particular vision for ICT in education and give the ICT job to a team of teachers that creates a program plan without much consultation. Some school heads think that if they are investing in expensive technology it shows their schools are technologically advanced (Corner, 2007).

Educational leaders must understand that technology integration is not about the technology itself, but about focusing on leading their teachers to change pedagogy to include 21<sup>st</sup> century teaching and learning strategies in order to support future generations of learners and increase learner achievement (Kozloski, 2006). Leadership must commit to the common goal of using ICT, otherwise it will never happen. Transformational leadership behaviours of principals play an important role in technology integration into the curriculum (Betz, 2000). ICTs will only be implemented successfully if the principal is in full support, if he/she is learning as well, provides adequate professional development and if he or she supports his/her staff in the transformation (Betz, 2000). The focus needs to be on purposeful teaching, efficient organisation and adaptive practice, with the School Governing Body (SGB) also being invested in the process (Imison & Taylor, 2001).

Principals should have a thorough knowledge of the technology and be convinced that it will make a difference to teaching and learning. It is not enough to just allow, for example, whiteboards in the school; direction must be given to teachers as to how and when they should use the equipment. "The mere introduction of this technology will not revolutionise the classroom; it is dependent upon addressing strategic management issues at all levels" (Bannister, 2010). Bannister (2010) emphasises that the right person leading the implementation of IWBs within an organisation is vital to its success. Regional advisors have to provide opportunities for clusters of schools to develop initiatives together (as happened in this network). This should include training and content creation, such as subject specific materials.

Staff must be encouraged to create, demonstrate and reflect in collaborative groups. The principal has to show a commitment to long term investment in technology and schools should have a learning and teaching team, co-ordinated by a member of the senior management team (SMT). The SMT needs to acknowledge the school development plan and be the bridge to classroom practice. The role of the SMT is to decide when and how the IWBs will be implemented into classrooms.

Principals must allow time to undergo training, of both themselves and their staff, and ensure that everybody does indeed undergo the scheduled training (Van Wyk, 2009). According to Yee (2000), principals should encourage their staff to participate in individualised professional ICT activities. If leaders use technology, then technology use in their schools is more likely. Technology use helps principals to develop effective decision-making, problem solving, and better accountability (Afshari, Bakar, Luan, & Siraj, 2012). Principals who are knowledgeable about computer technology can personally assist their teachers (Brockmeier, Sermon, & Hope, 2005), and setting a good example is the best way in which a principal can promote successful use of technology (Van Wyk, 2009). Principals are role models if they apply computer technology to administrative and managerial tasks (Brockmeier et al., 2005). According to a study done by Yee (2000), teachers are of the opinion that if principals do not have experience with the technology themselves, they do not recognise the capabilities of ICTs and will not allow for it in the budget. Teachers expect that principals make ICT learning a big part of their professional development so that they will be able to imagine the possibilities that technology might offer to their schools (Yee, 2000).

There is a shift away from focussing on the personal attributes of successful leaders towards focussing on the interactions between their behaviours and the situation wherein they exist, which includes the followers and culture of the organisation. ICTs should be seen as an integral part of the school's effort to provide its pupils with an enriching learning experience (Ho, 2006).

Within the more traditional ICT environment, new technology is introduced within a single school, thus maintaining traditional lines of reporting and management. Within the context of this study we are looking at a much more complex management configuration where ICT is introduced within a cluster of schools, thus creating

multiple lines of reporting and new management challenges. According to Tondeur, et al. (2008), school principals should develop a shared ICT integration policy and cooperation between schools. Literature on management within such a context suggests a combination of traditional hierarchical (line function) and matrix management.

## **2.5 Management of an ICT network**

ICT managers plan, organise and direct computer-based projects. They liaise with other managers to decide on the project plan, ensure that the right equipment and staff are available for the project, schedule tasks and oversee them until completion. They ensure that project goals such as network management are met (DTWD, 2014). They need to be able to work collaboratively with colleagues throughout the school, communicate effectively with colleagues and learners, and provide training and support on ICT packages. They have to understand the use of ICT in a classroom setting and have good analytical, problem solving and administrative skills. They need a good understanding of health, safety and welfare regulations and best practice affecting ICT, which includes data protection compliance, the responsibility for data security and file management. They must be able to manage appraisals of technicians and encourage their development, work without supervision, delegate work effectively, keep calm under pressure and inspire and motivate others (Baker, 2012). The manager needs an in-depth knowledge of computer networks and a range of software applications, hands-on experience of troubleshooting hardware such as servers, modems, routers and network interface cards and excellent knowledge of current protocols and standards as well as understanding of telecommunications principles. The role encompasses the strategic development and implementation of ICT systems, the management and maintenance of these systems to provide an infrastructure that will support the future ICT needs of the school and the effective management of its limited financial resources, as well as the day-to-day installation, management, technical support, maintenance and development of ICT resources for the whole school. The ICT manager needs to liaise with all ICT related external suppliers and contractors (Bridgend, 2015).

According to Bowers (2013), being an ICT manager is very different today compared to how it was even five years ago. ICT managers have to create an environment where employees are encouraged to take chances and feel safe to fail. The manager needs to define the boundaries and encourage collaboration. It is important to hand over control and work through other people. He or she needs to be self-aware and know their own style. Good managers listen well and ask the right questions. They make quality, timely and faster decisions. Given the technical nature and complexity of most issues, problem solving is the key. Looking forward is critical to succeeding as a leader (Bowers, 2013). ICT managers identify any critical issues that threaten projects and handle them resolutely. They do not only have generic project management skills, they have a deep familiarity with their field, which gives them a natural authority (Baker, 2012). Personal characteristics like integrity, reliability, flexibility, calmness and confidence, as well as business characteristics like basic money management, organisation, delegation knowledge, communication qualities like active listening and constructive feedback and relationship qualities like being a team player and mediator, and having respect for others, are of the utmost importance (Admin, 2011).

There is growing optimism that technology, particularly ICTs can help to achieve development goals and spur progress in developing countries. ICT for development projects include a set of activities requiring hardware, networking systems, software, applications and human activity, with the end goal of technological changes. These projects are not standalone, but part of the integrated whole of management. ICT projects are similar to conventional projects in the sense that they are transitory undertakings that use resources, incur costs, and are expected to produce deliverables over time. These projects are meant to solve problems and meet challenges. They introduce technological changes to an organisation that are intended to be beneficial to the organisation and its target group (Macapagal, 2010) Definitions of ICT project management indicate that it is a method, discipline and process, with a set of tools for planning, implementing, maintaining, monitoring and evaluating of activities, and that major challenges are managing the project scope and resources, like time, cost and people. Vital factors of project management are people, process and technology.

Projects are developed, implemented and managed by **people**. Project managers need to understand the roles and participation of people, namely stakeholders and beneficiaries. Expectations of people need to be managed. Beneficiaries need to take ownership, because they will be the ones using, integrating and sustaining the systems developed.

A precise **process** should lead to the discovery of potentialities, and enhance the competencies of project staff members.

**Technology** refers to the hardware and software available in the market to support the needs and processes of the organisation. Technology should be used to support the needs of the people in the organisation (Macapagal, 2010).

Also, according to Macapagal (2010), qualified and competent managers must be prepared to handle:

- the project scope (vision, goals, technical specifications, includes only the work required to complete the project successfully)
- time (duration of project and estimated time when tasks will be completed)
- cost (managing money that will be spent for resources, activities, tasks and services so that the project is completed within the approved budget)
- human resources (managing people, individuals, teams, professionals assigned to the tasks)
- risk (uncertainties that pose threats, limitations or obstacles to the achievement of project goals)
- quality (ensuring user focus and reliability of project performance and that the project will satisfy the objectives for which it was undertaken)
- procurement (managing the process of acquiring goods, services, infrastructure and equipment needed by the project to meet its goals, objectives and deliverables)
- communication (includes the processes concerning the timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information)
- integration (the coordination and coherence of tasks, actions, activities and documentation)
- issues (managing problems raised by users)

- change (request for change that will impact on the sequence and process of the project and changes that will affect the organisation of the school).

No projects are exactly alike, but all projects usually progress through the same five project management phases, namely initiation, planning, execution, monitoring and control, and closure (ISMF., 2010). The initiation phase consists of the processes that facilitate the authorisation to start a new project. The organisation's needs are identified, the feasibility of the project documented, the scope and resource requirements refined. The planning phase matures the project scope and cost, gives emphasis to the schedule, technology and risks and schedules the project activities. Planning is iterative and ongoing, and as new information is discovered, additional requirements, opportunities, risks or constraints will be identified. The execution phase aims at completing the work defined during the planning phase. It involves coordinating people and resources, integrating the project activities according to the plan and addressing the defined project scope. During monitoring and control, the project performance is observed and measured regularly to identify diversions from planning and to identify potential problems in a timely manner. The closure phase relates to the formal termination of all project activities, the hand-off of the project to others or the closure of a cancelled project (ISMF., 2010). In this project, there will be no closure; it is an on-going project. The project is in the monitoring and control phase, having already been through the initiation, planning and execution phases.

## **2.6 Systems thinking approach**

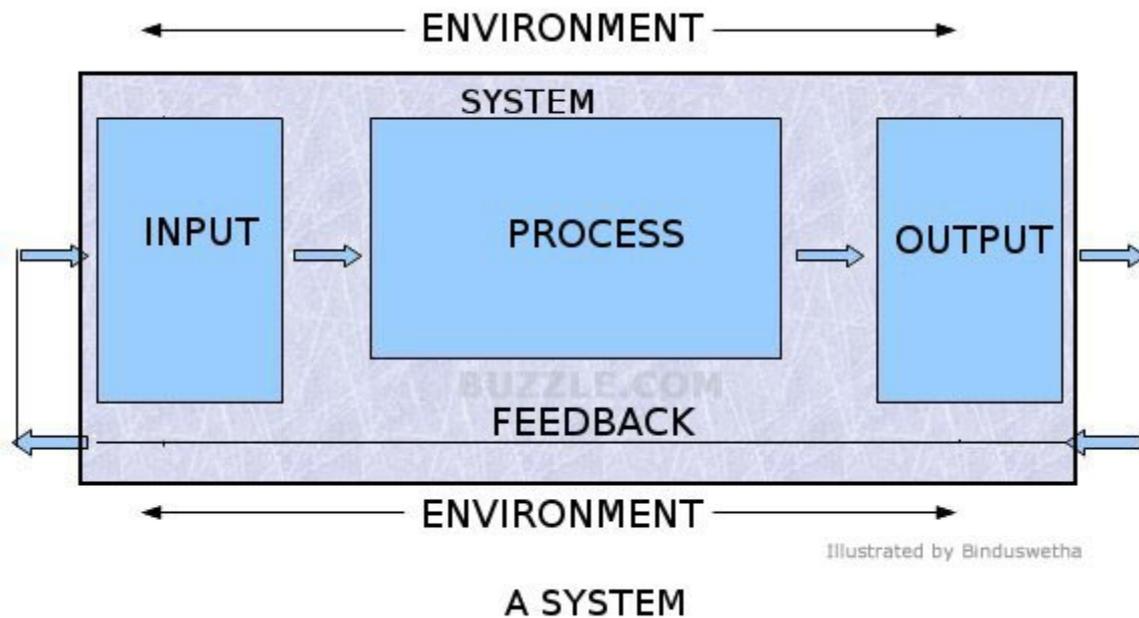
Systems thinking is an approach to management that views all key processes as parts of an overall system and interrelated (Furst-Bowe, 2011). The system is greater than the sum of its elements and the relationship among the elements adds value to the system (Betts, 1992). Education is a system comprised of things like learners, teachers, parents, administrators, subjects, curriculum, funding and buildings, together with sub factors like ambitions, vision, cultural and spiritual beliefs. This system relates to other systemic factors like educational leadership and management (Despres, 2004). The systems approach views, in this case the IWB project, as an interconnected purposive system that consists of several sections. It is essential to see the entity as a whole system.

As shown in figure 2.2 the system can be broken into three parts, namely input, process and output (Buzzle, 2012). In this case the inputs are human resources, strategy, capital and technology. The process refers to activities related to management, namely planning, organising, staffing, leading, controlling, monitoring and co-ordinating. The outputs are the products, in this case the knowledge, skills and good results as a result of the transmissions, as well as the obtaining of bursaries for further study.

The feedback in the system focuses on the information utilised for executing certain operations. This management approach enables the leadership to see the project as a section on its own, but it has a substantial effect on other sections of the school, like the normal day-to day administration of the schools, curriculum and assessment planning. Such a system may enable the management to efficiently determine the long-term goals of the schools (Buzzle, 2012).

A system has internal and external subsystems (Buzzle, 2012). In this case the internal subsystems can be all the schools taking part in the project, while the external environment comprise of many other schools not involved in this project, but still operating in the same province. The Mathematics, Mathematics Literacy and Science subjects can also be seen as internal, while all other subjects not involved in the project, but taught in the same schools, can be seen as the external environment. The system can also be open or closed (Buzzle, 2012). In an open system the elements of the system can interact with the environment, like in this system. This interaction can for example involve the transfer of resources. It may be that the IWB or IWBs in a school are not only used for transmission in Mathematics or Science, but for other subjects, not part of the networked transmissions, as well.

**Figure 2.2: Input Output Diagram**



Taken from: <http://www.buzzle.com/articles/systems-approach-to-management.html>

Schools usually tend to be more mechanistic than organic, as evident in things like class periods of fixed length, a single text book for all students, classes of the same size, etcetera. In this network the school management became more organic with many variables (Betts, 1992). The perspective shifted from a one-to-many (one teacher providing information to many students) to a many-to-one (many information resources available to one student) (Betts, 1992). In the changing networked world, individuals in positions of authority do not have enough power to influence networks, and anyone can become a leader (Despres, 2004). “Leaders with a systems management approach guide synchronous actions across the entire organisation, assuring alignment and integration of all units to maximize resources and productivity” (Furst-Bowe, 2011, p. 2).

## **2.7 Theoretical framework: matrix management**

Coming out of the aerospace industry in the 1950s, matrix management became popular in the 1970s and early 1980s. It was inappropriately implemented in many organisations and abandoned when performance did not meet expectations. In these cases, the inability to manage the matrix is an indication of a deeper problem, like the failure of leadership, misaligned goals, culture typified by politics and power

plays (Bell, 2004). Later managers noticed that the matrix worked at some companies and they realised that it could still be valuable. The result is that, around the late 1990s, the concept of a matrix assumed its normal place in management (Galbraith, 2009). The reality is that it must be mastered if an organisation hopes to become a highly adaptive, agile, real-time organisation (Bell, 2004). The matrix's use has grown rapidly because it is the only organisational form facing up to the need of senior managers to balance multiple considerations in their decision-making, and it is responsive to both internal and external constituencies in its functioning. For the matrix, multiple dimensions are its reason for being, and it organises explicitly around them. But the resulting work environments can be complex, ambiguous, and often frustrating ones to work in and manage (Hill & White, 1979).

Matrix management is a "mixed" organisational form in which normal hierarchy is overlaid by some form of lateral authority. "In a matrix there are two chains of command, one along functional and the other along project lines. Instead of dividing a project into separate parts or creating an autonomous team, project participants report simultaneously to both project and functional managers" (Larson & Gobeli, 1987). According to Sy and D'Annunzio (2005), "the matrix is a grid-like organisational structure that allows a company to address multiple business dimensions using multiple command structures". Edgeli (2007) describes the matrix as a "rectangular arrangement of elements into rows and columns, the horizontal and vertical, intersecting into a grid or network of interfaces. A matrix interface is the focus of authority and responsibility, determining who works with whom on a project. The matrix structure is an intricate latticework where people and roles are interwoven in delivering service within functions and to projects and matrices demonstrate the inter-relationships that exist between people who deliver a particular service to each other" (Edgeli, 2007). For this reason we might do better to focus not on dual authority but on dual group membership. One of the defining characteristics of a matrix organisation is that it contains members who are allocated to two groups. Most commonly, one of these is a specialist or "functional" department, the other a project group. What is important about these groupings is that they are both work-related; their constitution is based on the need to get the organisation's work done. They have to be legitimate; informal groups or cliques are excluded. They tend to be on-going; occasional committees are unlikely to be seen as a matrix (Knight, 1979b)

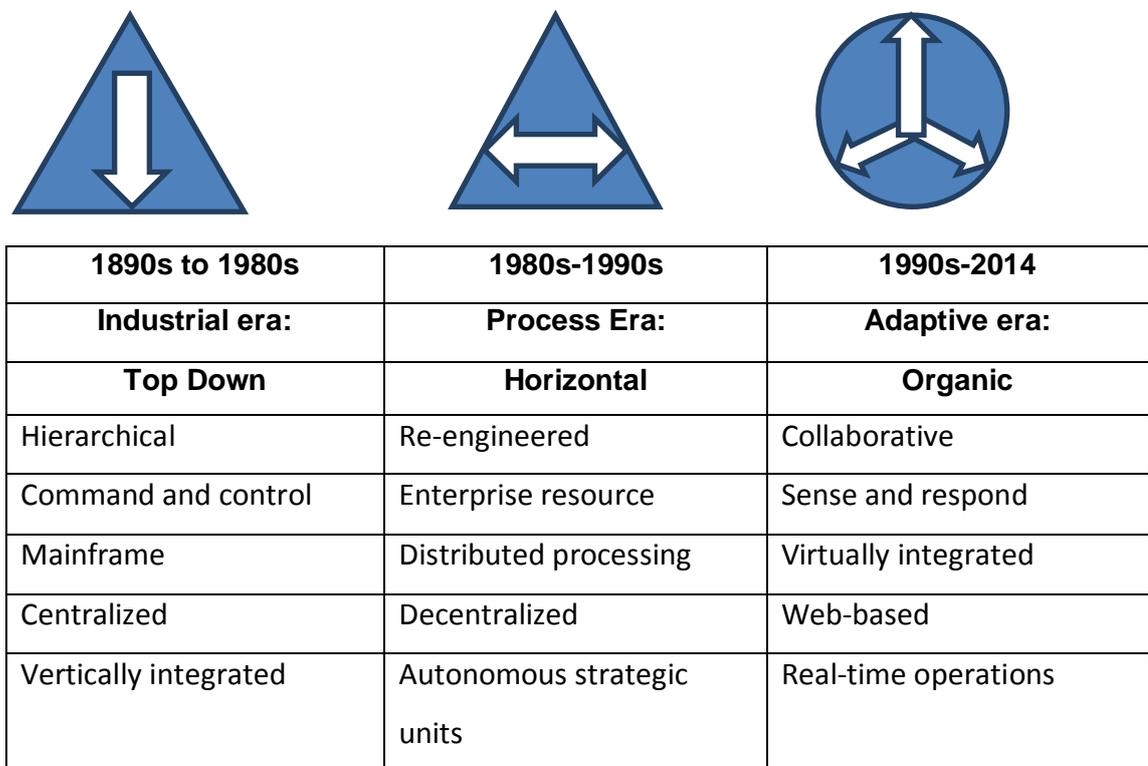
While the bulk of attention is directed towards matrix structures operating in high-technology settings, the defining characteristic of the matrix is still its dual orientation (Bresnen, 1990). Therefore, it is not just technology that constitutes the rationale for a matrix organisation, but the need to respond to two sets of complex and dynamic environmental conditions, one of which may be technological change (Bresnen, 1990), as is the case in this project.

Organisational theory has for many years been dominated by bureaucratic theory with high levels of role specialisation; full specifications of technical methods; detailed formal descriptions of role-holders' rights and obligations; a hierarchical structure of control, in which vertical interaction and top-down decision-making were the norms; and an emphasis upon internal and position-based loyalty and affiliation (Bresnen, 1990). The chief advantage of such "functional" organisations is that they achieve fairly efficient specialisation of labour, so that employees clearly understand their roles and responsibilities. As a result functional structures reduce duplication of work, but highly functional organisations struggle with communication problems, tunnel vision, and slow response to changing external conditions (Gottlieb, 2007). Although a hierarchical arrangement may suit many state organisations and institutions, it does not support the organisation and management of projects or systems that cut across a number of organisations within a bureaucratic system. In these cases, matrix management as an organisational theory seems to be much more apposite.

One of the factors that make it difficult for matrix processes to gain acceptance is what is called hegemony. The concept of hegemony rests on the observation that most societies are hierarchical in many ways. We internalise the taken-for-granted assumptions of our culture and its hierarchical relationships and come to see them as normal and natural. Therefore, any attempts to break down these arrangements are often met with heavy resistance. The imposition of matrix management is being perceived as outside of the normal and forces members of the organisation to ask questions about their most basic beliefs. This is difficult because it asks people to question assumptions that make their world stable and predictable (Gottlieb, 2007).

The matrix organisation challenged the fundamental precept of organisational design: the unity of command and control that characterized the bureaucratic structure. For more than a century, management achieved control and stability through centralised planning. In the 1980s, the matrix organisation started to design management processes and horizontal work flow, supported by distributed computing. This was the era of decentralization (figure 2.3). With the advent of network computing in the 1990s, the matrix evolved further into a highly dynamic work system with organic work flow in multiple channels (Bell, 2004).

**Figure 2.3: The evolution of the matrix**



Source: Bell, M for Gartner Research (2004).

According to Kolodny (1979), effective management of a matrix organisation calls for the use of mechanisms contrasting sharply with those of traditional organisations. Whereas this study looks at the management of a project that involves a number of schools, each with its own management structure, matrix management seems to be the most relevant theoretical lens through which to study the management challenges faced by the project and the schools.

Matrices will not work if there is a lack of role-definition in terms of divisions, departments and individuals (Sheane, 1979). A well-functioning matrix requires trust and a willingness to share control over individual territory for the collective good (Gottlieb, 2007). The success factors in a matrix are shown in table 2.2. The first success factor is management that continuously communicates and reinforces organisational purpose and brings consistency in the matrix operations. The second key factor is process excellence, defining explicit roles and critical timelines. The third is people selection and development. Although employees typically learn via formal training, the matrix structure offers a venue for honing staff's technical and management skills. Functional managers need to allocate resources for formal training to ensure that employees have the knowledge to work effectively in multidimensional matrix structures. The final success factor is building an agile infrastructure for cross-functional collaboration. Within organisations, collaboration links people to each other and to information and knowledge, to the advantage of communities (Bell, 2004).

**Table 2.2: Success criteria in the matrix**

<b>Criteria</b>	<b>Characteristics</b>
<b>Leadership imperatives</b>	Dynamic leadership and management, vision, mission and purpose and change management.
<b>Process design</b>	Provides clarity in roles, responsibilities, interdependencies, workflow, resources, unites people and purpose.
<b>People dimension</b>	Develops skills and competencies to foster collaborative and purposeful behaviour, training and development, incentives.
<b>Infrastructure enablement</b>	Workplace agility, connectivity, maximum flexibility, collaboration, knowledge access.

Source: Bell, M for Gartner Research (2004).

According to Bell (2004), the matrix should depict products or processes. There are not sharply defined units with autonomous managers in the matrix. Managerial teamwork should be the rule and the group emphasized. Managers should lead and manage with inspiration and put the needs of the organisation first.

Companies can apply the matrix in a variety of ways. “Temporary matrix systems may deal with specific projects, or a matrix may be a permanent fixture. Specialists may work full time on one project or contribute to a variety of projects” (Larson & Gobeli, 1987). In some cases the vertically structured hierarchy cannot cope with the horizontal requirements quickly enough. The organisational solution is to decentralise and delegate decision-making around a specific task to a project manager (Kolodny, 1979), to take some of the pressure of the top management. The organisation acknowledges that the project orientation should not be treated as a secondary concern by functional managers. The choice of a project form of organisation results in a more centralised control over the project, where the project managers plan, organise and control the tasks and take responsibility for the results (Kolodny, 1979).

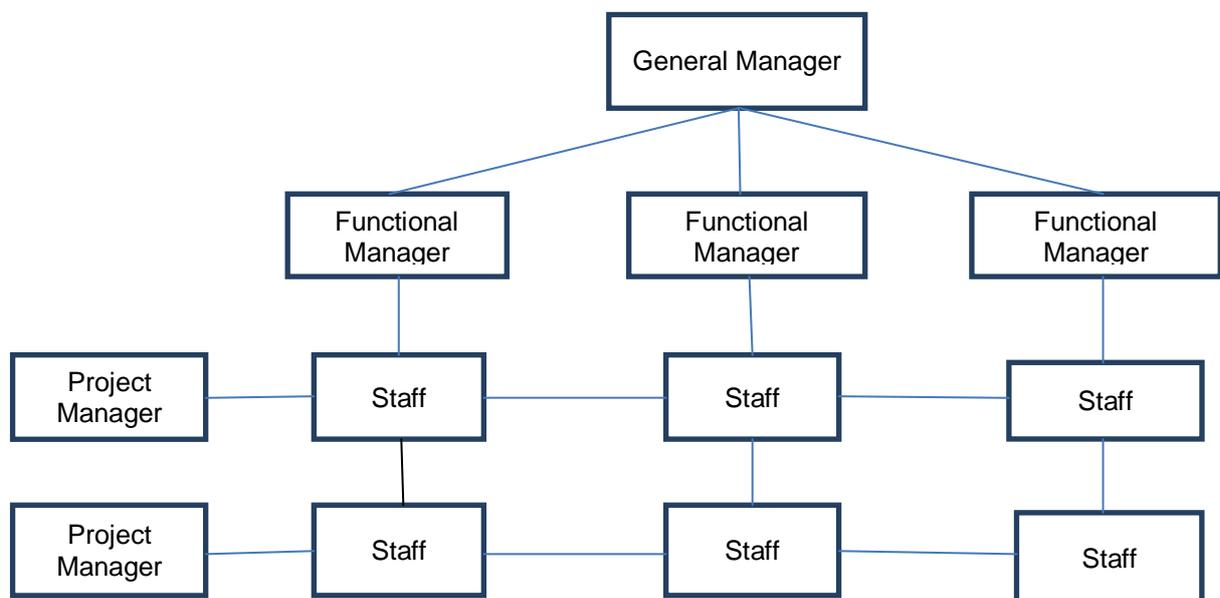
There are different types of matrices. According to Bobera (2008), a strong matrix is similar to the pure project organisation, and is adopted for process-dominant operations where the project managers take charge. A weak matrix is more similar to the functional organisation, which is adopted for functionally dominant operations, where functional managers direct cross-disciplined teams, composed of employees from different organisations (Bobera, 2008). In a balanced matrix a project manager is assigned to supervise the project and interacts on an equal basis with functional managers (Larson & Gobeli, 1987). Employees are members of two organising dimensions and the balanced matrix strives for equalized power and authority between these dimensions and equal pursuit of multiple business objectives (Sy & D'Annunzio, 2005). The balanced matrix is most appropriate for dynamic, diverse, event-driven, distributed and technically complex activities.

Knight (1979a) also identifies three principal approaches to matrix management and calls them the co-ordination model, the overlay and the secondment model. In the co-ordination model, staff usually remain members of the functional departments, in the overlay, staff officially become members of two organisational groupings, each with its own manager, and in the secondment model, individuals move from functional departments into project groups or back again, but belong to only one at a time (Knight, 1979a). The term matrix organisation is sometimes restricted to only the overlay model, but the broader term matrix management tends to include all

three. The emphasis in the overlay structure is on ensuring a simultaneous two-way flow of information. It also maximises the accountability for goal achievement of the project manager and for resource utilisation of the functional head. The aim is to equalise the authority and power of the two managers. Most overlay structures seem to tilt either towards the co-ordination matrix or the secondment model, but the principle of striking a balance between two equally valued sets of objectives remains important (Knight, 1979a).

In figure 2.4, the management structure of a possible ICT project is shown. In this case, the cluster of schools form a matrix where specialist teachers in Mathematics, Science and Maths Literacy may work exclusively on this project, or be part of this and other projects simultaneously. The principal fulfils the role of the general manager. The HODs act as the functional managers with vertical reporting lines, while the project managers take care of projects with horizontal reporting lines.

**Figure 2.4: Illustration of the management structure of the ICT project**



Adapted from Edgeli (2007).

According to Runeckles (2004), managers increasingly face important decisions about ICT and there are several reasons why ICT should be singled out. It is essential, expensive, complex, and is used to manage information and to communicate. But no matter how important and difficult ICT can be, it is only a means to an end and not an end in itself. It is a tool for fulfilling or enabling an

organisational purpose. In developing an approach to managing ICT, the use of ICT must be driven by the goals of the organisation. Decisions on ICT policy must be taken on school management level. The school needs a technology plan or strategy with broad guidelines or principles, then staff and managers need to be trained to apply them effectively (Runeckles, 2004).

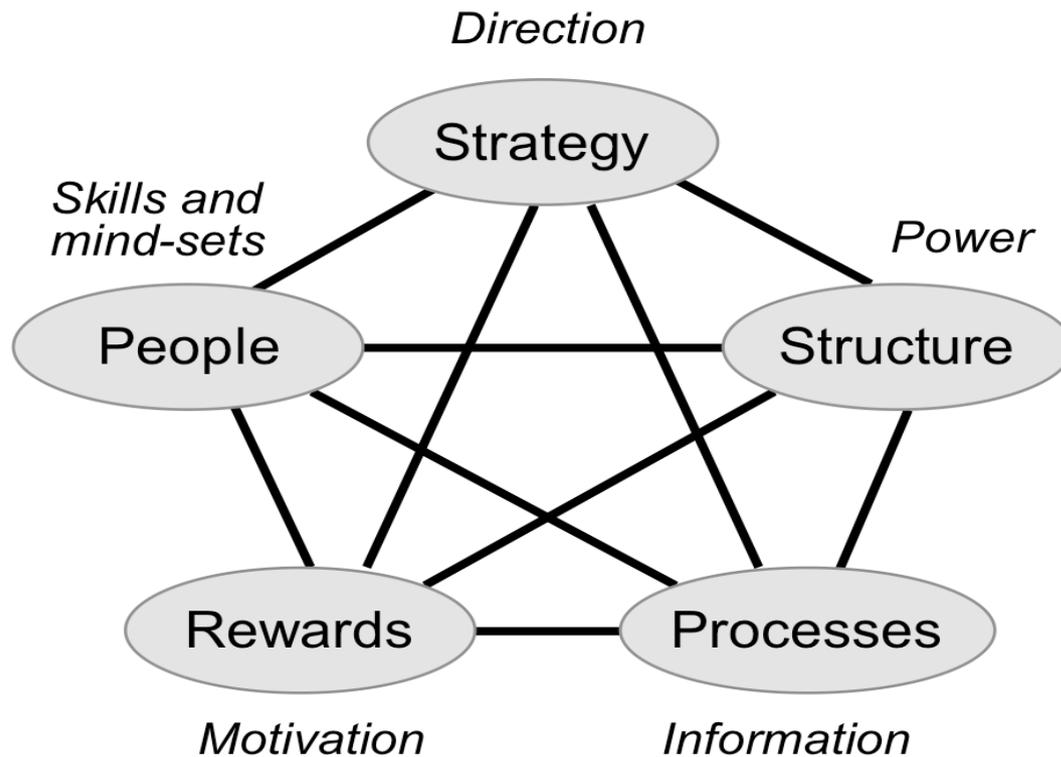
According to Janićijević and Aleksić (2007), matrix organisation is a controversial model of organisational design. This complex organisation introduces a number of challenges for managers who need to implement it in practice. “The complexity of the implementation of the matrix organisation stems not only from the complexity of the matrix organisational structure, but also from the fact that this model introduces radical changes in several other organisational dimensions” (Janicijevic & Aleksic, 2007).

To illustrate this, Janićijević and Aleksić (2007) take Galbraith's Star Model™ as the starting point. The organisation design framework portrayed in figure 2.5 is called the "Star Model".

In this model, according to Janićijević and Aleksić (2007), design policies fall into five categories. *Strategy* is determining direction. *Structure* determines the location of decision-making power. *Processes* have to do with information flow, *rewards* incorporate the motivation of people to perform and address organisational goals and *people* are dealing with human resource policies.

The implementation of the matrix into these organisational dimensions is done firstly on the strategy level, then on the structure, systems and processes (rewards) levels and lastly on managers and employees (people) level. It is a dynamic process which requires sufficient time to undertake, and time lag is likely to occur. “If the time lag between the implementation phases is too long, organisational inconsistency might lead to a decrease in organisational efficiency. This gap is the main cause of organisational problems in the process of implementation of the matrix organisation” (Janicijevic & Aleksic, 2007).

**Figure 2.5: The Star Model™**



The Star Model (Galbraith, 2009).

Strategy specifies the objectives and missions to be pursued and the products or services to be provided. It dictates which activities are necessary and which ones are secondary. In a matrix structure, it must be possible for two or more activities to be accomplished at the same time without hindering each other, and two or more dimensions are reporting to the same leader at the same level (Galbraith, 2009). The structure determines power and authority in the organisation. Information and decision processes cut across the organisation’s structure and can be vertical and horizontal. Vertical processes allocate resources like funds, training and talent, and horizontal processes are designed around the workflow, like new product development (Galbraith, 2009). The purpose of the reward system is to align the goals of the employee with that of the organisation. It provides motivation and incentives for employees to carry out the strategy. Reward systems are only effective if they are consistent with the other design choices. The people area governs human resources policies of selection, training and development. HR policies build the organisational capabilities to execute the strategic direction (Galbraith, 2009). The

interweaving nature of the lines of the star shape suggests that all policies must be aligned. Such an alignment communicates a consistent message to the company's employees (Galbraith, 2009).

Matrix organisation is not simply a design of structure. It is a combination of four factors: 1) matrix structure - dual chains of command; 2) matrix systems, operating along two-dimensions simultaneously - planning, controlling, appraisal, and rewarding along both functional and product lines at the same time; 3) matrix culture - this includes a tradition of change, the open and frequent exchange of ideas and positions on issues, and the sense of challenge and experimentation, 4) matrix behaviour - a matrix organisation differs from the traditional structure in that it places less emphasis on authority and more on people's behaviour to get the jobs done (Sethi & Namiki, 1984).

Knight (1979b) lists the criteria for a matrix: Sometimes a matrix is introduced for the purpose of **efficiency**, with examples in higher education. In these cases, the matrix creates the ability to build up specialist resources, and achieve an optimal level of their deployment. A matrix may help to increase existing levels of efficiency when project groups are introduced in a functional organisation. It can also be used to increase efficiency when important resources are dispersed between sub-units.

A matrix is often employed in recognition of the need to have two forms of **accountability**, related to the efficient use of resources and the achievement of specific task goals. The accountability for two sorts of performance is also often the reason for introducing a matrix. Dual accountability is a major reason for the existence of a matrix. There are many levels of **coordination**. The matrix can simply be a means to ensure consistency in the application of rules and policies, or in professional or technical practices, or it can include the avoidance of duplication between departments or units, and the avoidance of harmful internal competition. **Adaptation** is seen to involve anticipation of, and rapid response to, changes in the organisation's environment, as well as the capacity for problem-solving and innovation. This requires expertise and creative energy from different parts of the organisation. The criterion of **social effectiveness**, the idea that the organisation structure should provide for a viable social system which satisfies the needs of its members, is far from simple, but a matrix can be used to support a number of

contradictory measures. Within the framework of socio-technical analysis, analysts tend to agree upon a list of specific socio-psychological needs that must be satisfied by work. The variety of social needs that matrix organisations sometimes fulfil, and sometimes fail to satisfy, emerges in case studies. Matrices can generate stress and confusion owing to conflict and ambiguity in individual roles and multiple group membership (Knight, 1979b).

According to Bobera (2008), there are different advantages of matrix management. The project manager has the full responsibility for project management within a framework of a defined budget, specifications and quality. The projects draw workers and their skills from functional departments. This contributes to breaking down traditional departmental barriers and allows individuals to use particular skills in a variety of contexts, at the same time, encouraging motivation (Riley, 2012). It is possible to carry out several projects simultaneously, while time, costs and performance quality are controlled. Management has the advantage of using the existing staff across functional departments, without needing to look outside the organisation for the necessary skills, and the result is consistency with respect to policies and practice (Bobera, 2008). If teams and individuals manage themselves, it frees up management time and allows for creative and flexible approaches. Attentive managers can offer opportunities for professional growth (Corkindale, 2008).

Corkindale (2008) alludes to a number of caveats that should be considered when adopting a matrix management model. Multiple reporting lines can cause conflict, stress and confusion if managers' interests are not compatible and parallel priorities are not always working efficiently. Management roles must be defined properly, otherwise it can result in disagreements or lack of accountability. Inattentive managers will cause stress and overwork. Although teams and individuals should manage themselves, it is very difficult to make the shift to self-management. Matrix systems are vulnerable to constant change which will result in the disruption of the relations that make them work, and knowledge and experience can be lost (Corkindale, 2008).

Bobera (2008) also researched the disadvantages of matrix management. He reckons that this management model violates the principles of the management-unity command, as the staff members involved have at least two managers. The project

will suffer if there is any doubt about the respective responsibilities of the functional and project managers, and the balance of authority in decision-making between the project and functional manager can be very delicate (Bobera, 2008).

In a study done by Sy and D'Annunzio (2005), the “top five common challenges in matrix management reported by participants were misaligned goals, unclear roles and responsibilities, ambiguous authority, lack of matrix guardian and silo-focused employees. There are also often disconnects between management levels in organisations that result in different experiences for leaders at different organisational levels”. The experiences of mid-level and top-level managers may be different within a matrix organisational structure. This could be a result of the different management functions, such as planning, organising, or controlling. Top-level managers should focus more on the strategy development or the planning function, while mid-level managers focus more on the organising function or implementing the strategy (Sy & D'Annunzio, 2005).

Factors providing difficulty in **goal alignment** are conflicting objectives between dimensions, lack of coordination, poor timing of work plans and insufficient communication. Unclear job descriptions and guidelines and not knowing who to contact for information are problematic in terms of **roles and responsibilities**. **Ambiguous authority** can be defined as confusion about who has the final say, lack of accountability, leaders that do not want to share decision-making and delays in the decision-making process (Sy & D'Annunzio, 2005). The **lack of matrix guardian** describes a situation characterised by lack of rewards to motivate employees, failure to identify performance problems, not ensuring senior level authority, and being unable to rely on the objectivity of the matrix guardian. **Silo-focused employees** refers to personal conflicts between leaders, withholding resources, lack of trust and communication between employees and the lack of skills to function in the matrix (Sy & D'Annunzio, 2005).

### ***2.7.1 The role of the SGB in a matrix organisation***

At the heart of the South African Schools Act (SASA), is the idea that parents should take responsibility for the education of their children in partnership with the government (EasternCapeProvince, 2012). A governing body is elected to govern a school and the members represent the school and community. Its main objective is

to promote the welfare of its school. SGBs determine the policies and rules for organising, managing and controlling of the school affairs. An effective SGB works as a team, has a good relationship with the principal, manages time effectively, for example at meetings, delegates to committees, knows the school through visits, and takes its own development seriously (EasternCapeProvince, 2012). A democratically elected SGB should improve the quality of education, ensure good governance and that the school serves the interests of the community, spreads the cost of education across users and combats all forms of discrimination and intolerance (DoBE., 2014).

The SGB controls the financial resources of the school and carries the responsibility for financial sustainability of ICT facilities in a school. If the State provides funding for ICT, it is up to the management to decide how to distribute the funds. This implies that management should have a good understanding of ICT requirements. If the State does not provide funding for ICT, management has to decide how much is required to maintain the current technology and how much is needed for things like additional electricity usage, staff training, upgrades, software, licence fees and additional software (Van Wyk, 2009). These are fundamental imperatives that require the SGB to be fully involved in the project and to support it and allocate the necessary funding. A sustainability plan is essential and it is the responsibility of the principal to ensure that all members of the SGB understand the importance of ICT and the reasons for ongoing financial support of technology.

SGBs have to adopt a constitution stating how they will operate, adopt a mission statement to set out the values of the school, adopt a code of conduct which sets out disciplinary procedures, help the principal and other staff members to perform their professional duties, decide on the school's admission, language and religion policy, manage the school buildings and grounds, decide on the times of the school day and give recommendations to the provincial Head of Department about the hiring of teachers (EqualEducation, 2011).

SGBs are responsible for school *governance*, which has to do with making decisions about how the school will be run, and the creation of policies and rules for the staff, learners and parents. School *management*, however, has to do with the actual day-to-day running of the school, which is the responsibility of the principal, together with the School Management Team (SMT) (Equal Education, 2011).

In table 2.3 the difference in the roles and responsibilities of SMTs and SGBs is shown.

**Table 2.3: Roles and responsibilities of SMTs and SGBs**

<b>SMT</b>	<b>AREAS OF RESPONSIBILITY</b>	<b>SGB</b>
Administer teaching and learning and organise supporting activities	<b>Teaching and learning</b>	Ensure quality education Decide on school times
Perform professional functions	<b>Professional functions</b>	Support principal and staff in professional functions
Decide on intra-mural activities	<b>Curriculum</b>	Decide on learning areas and extra-mural curriculum
Decide on what to buy	<b>Textbooks, materials, equipment</b>	Buy materials if school has section 21 status
Perform functions in support of SGB	<b>Financial planning and management</b>	Raise funds, administer school funds, control records, prepare budget, collection of school fees
Perform specific tasks in support of SGB	<b>Property, buildings and grounds</b>	Control and maintain school buildings and grounds
Assist in developing learner code of conduct	<b>Mission, code of conduct, welfare</b>	Promote school's best interest, develop mission and vision statement, adopt a code of conduct and constitution, encourage members of school community to partner school
Manage personnel	<b>Personnel</b>	Recommend appointments of state employees and employ SGB paid employees

Source: (EasternCapeProvince, 2012).

### **2.7.2 The role of the school management team (SMT)**

The SMT consists of the principal, deputy principal and HODs. It is their role to ensure that the school ethos is dynamic and supportive of an effective teaching and learning culture (Ndou, 2009). The SMT's functions range from planning and budgeting to organising and staffing, implementing policy, controlling discipline, problem solving, monitoring and evaluating plans and motivating staff (Clarke, 2007). It is expected from school managers to be more than managers of schools; they are

required to become agents of change, visionaries, effective problem solvers, consensus builders, and role models of practice (Kozloski, 2006; Leonard & Leonard, 2006). The GDE places emphasis on the role of school managers in managing ICTs in schools and has developed guidelines for school management on how to implement, manage and sustain the usage of ICTs in public schools in Gauteng (GDE., 2011). In the Mpumalanga Department of Education, such guidelines do not exist. In addition to setting goals and policies relating to ICT, having a shared vision is critical to managing ICTs in a school setting. The SMT's vision for ICT practice in a school affects the school's vision for ICT practice and determines the kind of ICT resources used and how ICTs are managed within a school (Bialobrzeska & Cohen, 2005).

### ***2.7.3 The role of the principal (General manager in the matrix)***

According to Kolodny (1979), a successful matrix organisation is always led by a CEO (principal) who understands how to make it work. The formal role of the general manager is similar to the top management role in a traditional organisation; it includes total responsibility for those activities subordinate to the position. The general manager is on top of, and outside, the basic matrix structure and has a clear perspective of all activities and staff in the matrix (Adams & Kirchof, 1984). For decades, the principal was seen as the chief strategic guru and organisational architect (Bartlett & Ghoshal, 1990). "But as the competitive climate grows less predictable, it is harder for one person to succeed in a visionary role. While formal, hierarchical structure gives way to networks of personal relationships, the image of top management in an isolated corner office, becomes blurred" (Bartlett & Ghoshal, 1990).

A paradox of the matrix is that it requires a strong command at the top to ensure a balance of power at the next levels (Lawrence, Kolodny, & Davis, 1979). The principal leads a dual command structure, namely the functional and the project hierarchies. This role involves three managerial concerns: balancing power, managing the decision context, and setting standards. Balancing power involves allocating budgets, delegating personal assignments, and applying schedules (Adams & Kirchof, 1984). Managing the decision context means the top leader must set the stage, but he must also delegate, as the organisation needs to cope with a

high volume of information processing. Lastly, the top leader should set the standards of expected performance (Lawrence et al., 1979).

Upper management creates the organisational environment, funds the development of information systems and oversees operating procedures. It is also responsible for “creating the mission and goals that provide the framework for projects, setting policies for addressing priorities and conflicts, creating and maintaining information systems, providing facilities to support project work, defining the limits of the manager's authority, and helping to resolve issues that cannot be handled successfully at lower levels” (Portny, 2013).

In terms of South African schools (Act 84 of 1996) the managerial powers in the school are vested in the principal. Even though it is the role of the SGB to draft and adopt school policies, most of the South African schools' decisions regarding policy implementation, remain the principal's function (DoE, 1996). “The Schools Act stipulates that the principal, under authority of the HoD (Education Department Head), must undertake the professional management of a public school. This means that a principal has delegated powers to organise and control teaching, learning and associated activities at the school effectively” (Mestry, 2004). The principal plays a dual role. He/she is responsible for the professional management of the school and is a member of the SGB. The principal must work collaboratively with the SGB and although the SGB is accountable to the parents for school funds, the principal is playing a supportive role in ensuring that the school's finances are managed effectively (Mestry, 2004).

There is a difference between management and governance. Governance is about representing the interests of the group of people who constitute an organisation, and pertains to translating the vision of that organisation into policy; management is about making decisions for implementing the policies. Governance is concerned with the setting of goals and the direction to be taken to achieve these goals, whereas management is looking after the day-to-day operations of running the organisation in a smooth manner (DifferenceBetween.Net., 2012).

The principal's role is a balance between leadership and management. Leadership deals with supervising and improving the instructional programme, identifying a vision and mission for the school, and building a relationship with the community.

Management deals with the budget, maintenance of the school buildings and grounds, and educational policies (Porten, Shen, & Williams, 1998). Principals should also take responsibility for the participation of other stakeholders like educators and Heads of Department in the school management (Steyn, 2002). Although parents' and learners' participation is limited to governance only, educators should be involved in both governance and management since they are faced with problems like class management (DoE, 1996).

According to Kozloski (2006), the traditional role of the principal was that of manager, keeping the day-to-day school events running smoothly. The leader in an organisation creates a vision for change and the manager plans and implements the details of the change. Today's principal must fulfil both roles and be prepared to sustain the vision and facilitate the change process. As an instructional leader for the 21<sup>st</sup> century the principal must play a leading role in technology integration.

#### ***2.7.4 Functional and project leaders in the matrix***

The roles of the functional and project managers in a matrix exist on the same level, both reporting to the general manager, (principal) and they must act on a cooperative basis if the matrix is to succeed. Both maintain some degree of authority, responsibility and accountability with regard to the organisation's projects. This means that they need to negotiate with one another continuously, and both must be committed to managing in a professional and productive manner the conflict that will inevitably develop (Adams et al., 1984).

According to Portny (2013), functional leaders are responsible for their staff's assignments among projects. They have to provide the resources for staff to perform their work according to the highest standards. They are also responsible for developing plans that specify the type, timing and amount of resources required for performing the designated tasks. They have to ensure that team members are available to perform their tasks, provide technical guidance to help solve project problems, provide the facilities needed for everyone to do their work, and invest in training for their subordinates. They have to complete performance appraisals, recognise quality performance with salary increases and promotions and approve requests for activities away from the job (Portny, 2013).

The project-functional interface is the state of divided loyalties individuals face when they have to answer to two bosses. While project managers want to decide who they can pick from functional teams to staff their project team, many functional managers do not want to release their staff to benefit the project managers. Control is centred on the functional managers and the project managers are at a disadvantage as a result of a lack of formal authority (Seet, 2009). Functional managers sometimes experience the matrix as a loss of status, authority, and control, because most major decisions are shared with other managers at either the same or a higher level (Adams & Kirchof, 1984). Functional departments are vertical in nature, whereas projects are horizontal in nature and they need expertise from across the functional units to complete their objectives. On paper, the two entities should support each other. At a school level, the HODs will fulfil the role of functional managers.

The project manager has a critical role as he/she deals with the interests of people who have a degree of control over the project's goals, resources and objectives. The project manager's responsibilities are to formulate a clear project plan to reach performance targets, determine resource budgets, manage project risks, sustain a focused and committed team, create the team's operating practices, monitor performance against plans, resolve priority or interpersonal conflicts as well as project issues and problems, control project changes, accomplish objectives within time and budget constraints, and contribute to team member's appraisals (Portny, 2013). Project managers represent top management on assigned projects. In carrying out their responsibilities, they work across traditional functional lines to bring together an organisational focus, so that the project objectives can be achieved. They are responsible for the results of the project, but they do not have the power to dictate (Cleland, 1984). Decisions on performance evaluations, pay adjustments, promotions, and job assignments are frequently influenced by project managers. They must use their knowledge, competence, personality, and group management skills to get their project's tasks accomplished within budget, on time, and within performance standards. They must rely on their interpersonal skills and ability to persuade (Adams & Kirchof, 1984).

Project management is the cornerstone of any matrix design. There are many challenges that confront project managers, like power struggles because boundaries

of authority and responsibility overlap; conflict, for example with respect to the use of shared resources; the coordination of work across projects; and securing motivation and commitment (Gottlieb, 2007). There are some universal attributes of project leadership, like taking ownership of problems. The project leader needs to impart all his or her knowledge pertaining to the project with the entire project team, and good project managers require the courage to confront the organisation and empower the team to do whatever they feel is required to succeed. Partnership takes commitment to build and grow and the best commitment is to tell each other the truth and deal with it constructively. Trust is the keystone of partnership and the partnership will be as good as the project manager's ability to build trust between team members (Gottlieb, 2007).

Seet (2009) suggests that project managers should understand the dominant ideology of the organisation as it determines the overarching communication needs. They have to customise the communication approach with the various stakeholders. It is imperative to secure the functional managers' buy-in through keeping them updated on the progress of their staff and the project. Being known as knowledgeable on the job is vital in building the project manager's influence and is an area wherein he or she can dictate. Clear and continuous feedback and encouragement is necessary. Project deadlines must be adhered to, and internal arrangements honoured.

## **2.8 Other management models worthy of consideration**

### ***2.8.1 Introduction***

According to Avery (2004), the field of study of educational management was derived from management principles first applied to industry and commerce. Theory development involved the application from industrial to educational settings. As the subject became more established, its theorists began to develop models based on their observation of schools and colleges. Ideas about leadership developed with particular characteristics which can be traced through a timeline from the nineteenth to the twenty-first century. It has been categorised into paradigms of classical, transactional, visionary and organic theories (Avery, 2004).

Most theories of educational management are normative; they reflect beliefs about the nature of educational institutions and behaviours of individuals in them, selective; they emphasise certain aspects of the institution at the expense of others and they are based on observation of practice in educational institutions (Bush, 2006). Formal models dominated the early stages of theory development and formal structure, rational decision-making and top-down leadership were the central concepts of effective management. But today, it is agreed that there is no single perspective for our understanding of educational institutions (Bush, 2006). Whatever style of leadership the principal develops, the focus on him or her as a single individual in a management position is not suitable for the long-term sustainability of the organisation (Dilts, 2007), and the most recent theories are moving towards participative and shared leadership. The introduction of new technology also presents complex challenges for schools, leading to changes in managerial practices and the emergence of new organisational forms (Liam, 2011).

### ***2.8.2 The organic organisation***

Theories in the organic paradigm have grown out of improvements arising from cultural change (Dilts, 2007). The twenty first century is characterised by globalisation and technology, creating immediate access to information. There is an emphasis on the rights and views of individuals. This is breaking down hierarchical boundaries and staff can be more immediately involved (Dilts, 2007).

When we think about leadership for inclusion it can be reached in all paradigms of leadership, but it is only sustainable within the organic paradigm. Inclusive educational leadership values social processes and teamwork; allows everybody to have his/her voice heard and enhances the possibilities to develop personally and professionally; implies an on-going change in the development of organisations; is built on values like autonomy, mutual respect and responsibility for others; and is seen as a process of the development of distributed power (Dorczak, 2011). Skills or competencies and the communication process are the most important. Personal development as a value is crucial for inclusive educational leadership. Inclusive leadership is appropriate to the needs of a contemporary society and serves the process of school development better than other management types (Dorczak, 2011).

The mechanistic organisation has a rigid structure and is found in a stable and predictable environment. On the other hand, the organic organisation is more fluid and appropriate for changing environmental conditions that require more emergent and innovative responses (Liam, 2011). Organic leadership tends to respond to environmental changes in a dynamic context (Kantabutra & Suriyankietkaew, 2012). The emergence of organic leadership is a phenomenon of the last two decades. High self-accountability, self-responsibility and adaptability are key values that enable mutual commitment among organic organisational members (Kantabutra & Suriyankietkaew, 2012). The success of the self-leading team depends on empowerment where members require little external leadership. Leaders are acting as coaches and not as directors, as in traditional paradigms (Avery, 2004). Through extensive communication and sharing of information, members in organisations can share, interpret, interconnect and achieve organisational goals. Through mutual sense-making members can influence the organisation's direction (Kantabutra & Suriyankietkaew, 2012).

The quality of interaction among individuals develops a sense of a professional learning community. The community is bound together by the sharing of beliefs supporting the organisation's mission. This implies a commitment to the generation of a school-wide culture. In a professional learning community, teachers participate in decision-making, engage in collaborative work and accept responsibility for the outcomes (Harris, 2003). This offers the opportunity to unlock teachers' leadership capabilities. This community connects the individual human activity of learning and the interdependence of the organisation members (Hiatt-Michael, 2001), and the members accept responsibility for the community's growth. The organisation is as effective as each individual's contribution. Members work together, understand each other, and respect each other's diversity (Hiatt-Michael, 2001).

In a school setting, all the workers must feel that their insights are valued. Parents and learners are participants in the school life, not simply the recipients of services. Every member has the responsibility to identify problems and seek solutions and each individual should feel rewarded by successes and distressed by community concerns (Hiatt-Michael, 2001). There are four essential elements to a learning community, namely: a leader who acts as a guide; a shared moral purpose; a sense

of trust and respect; and an environment for collaborative decision-making (Hiatt-Michael, 2001). The leader has to convey the organisation's purpose in a manner which is understood by all the community members. The shared moral purpose should capture the personal values of the individual members and drive the culture of the learning community. The leader's actions should promote a sense of trust and mutual respect among all members. Opening up the school so that parents can become part of the community is difficult for most principals. Members of the school's administration, staff, learners, parents, community members and the SGBs need to be constantly looking for better ways to do things and take initiative in applying them at their school (Hiatt-Michael, 2001).

Organic leadership and community are about the way in which a community pursues direction, through collective experiences. It is about reaching and achieving goals. When situations of urgency arise, close-knit relationships are vital to the organisation. The organic organisation requires a complete shift in thinking so that notions about control, order, hierarchy and power are replaced by concepts like mutual respect and acceptance of the on-going process of organisational change. Created by professional individuals, organic leadership is a socially constructed process (Avery, 2004), in which direction is discovered rather than decided. According to Sebastian and Bombaci (2012), the organic management structure is characterised by flexible task definition, communication, low degrees of formalisation, and decentralised control. Liam (2011) also researched the characteristics of the organic management structure and concluded that individual contributions play a prominent role in organisation and adjustment of individual tasks occurs through interaction with others. The direction of communication is lateral rather than vertical and knowledge is located anywhere in the network. Sebastian & Bombaci (2012) conclude that matrix management structures are considered to have many of the characteristics of an organic management structure.

Sebastian and Bombaci (2012) also discuss the advantages of organic management structures and state that it is useful when the environment in which an organisation operates is subject to various rapid changes. The organic management structure should be used in situations where staff members are empowered to resolve problems and make decisions, and communication should be used to provide

information and advice, rather than giving instructions. As technology becomes more elaborate and tasks more unpredictable, organisations adopt more flexible structures, by moving away from bureaucratic to organic organising forms (Liam, 2011). A disadvantage of this type of structure is that it doesn't work well if tasks are large and complex and require significant integration of resources and staff to accomplish strategic goals (Sebastian & Bombaci, 2012).

An adhocracy can be classified as an organic organisation. It is a highly flexible project-based organisation that relies on the adjustment of problem-solving teams and is designed to deal with complexity (Liam, 2011). In this project, an adhocracy developed as a result of teams, including the SGBs, principals, project organisers, HODs and teachers, working together to make this network a success. An adhocracy is an adaptive form of organisation, placing professionals with varied skills and knowledge into project teams to solve complex problems. Knowledge creation occurs within teams that can be composed of employees from different organisations. In this network, teachers from different schools work together to ensure the success of the project. The adhocracy has a permeable organisational boundary that allows new ideas and knowledge from outside (Liam, 2011).

### ***2.8.3 Distributed leadership***

The distributed leadership model falls within the organic paradigm. It focuses on the “what” of leadership - structures, functions, routines and role, instead of the “how” of leadership - the daily leadership routines and functions (Spillane, 2005) and forces us to recognise that the arrangement of leadership and management responsibilities emerge in the lived organisation (Spillane, 2009a). The emphasis is on the interactions between leaders and followers that distribute influence and power through the institution in a manner that presents opportunities to realise expertise and enable responsible action. It calls for empowerment rather than delegated responsibility (Dilts, 2007).

This model is not a blueprint for leading and managing; practitioners may rather use it as a framework to diagnose leadership and management practice and design for its improvement. It draws attention to the problem of heroic leadership that equates school leadership with the figurehead of the principal. This is inaccurate, since no

principal singlehandedly leads a school to greatness. Leadership can be distributed effectively across two or more leaders who work separately but interdependently. It is a product of the interactions of school leaders, their followers and the situation, not of the actions of an individual leader (Spillane, 2005). Shared meanings represent the culture of an organisation, its values, philosophy, rules and climate. In this view, leadership is about constructing meaning collaboratively. It involves opportunities to mediate perceptions and assumptions through continuing conversations (Harris, 2003). Leadership is socially constructed and culturally sensitive. It is not a leader/follower divide, and it does not point to the leadership of one person (Harris, 2003).

Understanding leadership and management using a distributed framework means attending to the practice of leading and managing, not simply to behaviours or approaches. To understand and diagnose the practice and design for its improvement, we have to move beyond the actions of individual leaders and focus on the interactions among school staff. Practice is where leadership and management meet the road of instructional improvement, through human development and developing the organisational infrastructure (Spillane, 2009). This idea has enormous implications for the way in which schools and districts are run. Instead of issuing orders down the chain of command, leaders set the vision and hold followers accountable for achieving it (Rothman, 2009).

The notion of distributed leadership has particular importance in districts, forming partnerships with community organisations, recognising that schools are not solely responsible for learner's academic growth (Rothman, 2009). Distributed leadership is not a nice extra; it is an essential foundation for sustainable improvements for school systems (King & Balch-Gonzalez, 2009). It must take place within large-scale partnerships across districts and communities to support learners' learning and development inside and outside of the school, especially in historically disadvantaged communities. This is exactly what happened in the schools in this project. Five of them can be regarded as historically disadvantaged, but they worked together in this network towards a unified goal, helping to bridge the digital divide. The strategies they employ require all shareholders to invest substantial time in building relationships, leadership skills and the ability to work together (King & Balch-Gonzalez, 2009). District leaders, who are willing to share leadership, take

advantage of the expertise that each group can contribute, while remaining sensitive to the groups' individual cultures, find rich resources available to support educational improvement and cultivate a sense of ownership among all the partners (King & Balch-Gonzalez, 2009).

Harris (2003) states that leadership is concerned with the relationships among individuals in schools and can be separated from person, role and status. Distributed leadership requires those in formal leadership positions to relinquish power. This places the principal in a vulnerable position because of the lack of direct control over school activities. Subject and departmental divisions also present barriers to teachers working together. Distributed leadership is a challenge in terms of who distributes responsibility and authority and how to effectively accomplish that.

Despite the difficulties, teacher leadership can occur if a school puts the appropriate support mechanisms in place and creates the internal conditions for teacher leadership to flourish. Time needs to be set aside for teachers to meet and plan issues. Diverse opportunities for continuous professional development are required and the self-confidence of teachers needs to be improved if they are to act as school leaders. There has to be a form of reward in the system (Harris, 2003).

Evidence indicates that, where distributed leadership is in operation and functioning well, teachers demonstrate greater professionalism in their role as facilitators of learning and engage openly in professional learning activities. They readily adopt change and cooperative behaviour and demonstrate greater commitment to improve their classroom pedagogy. Teachers engage collaboratively with their colleagues in reviewing existing teaching and learning practices and accept a pronounced role in decision-making and participative activities (MacNeill & Silcox, 2006).

Collegial models include all the theories that emphasise that decision-making should be shared among some or all of the members of the organisation. They are normative in orientation and are appropriate for organisations that have a significant number of professional staff who have a right to share in the decision-making process and who are thought to have a shared understanding of the aims of the organisation (Bush, 2006). Where responsibility and leadership are distributed throughout an organisation, it is more likely that sustained change will be achieved.

While an enthusiastic teacher or principal may make an impact, unless there is a commitment throughout the institution, it is unlikely to become part of the culture (Becta, 2007). Collegial models have a common set of values that guide the managerial activities and lead to shared objectives. They assume that decisions are reached by consensus and that it is desirable to solve problems by agreement (Bush, 2006). Shared decisions are more likely to be implemented effectively.

Bush (2006) also highlights some limitations to collegial approaches. They are so strongly normative, that they tend to obscure reality. Decision-making tends to be time-consuming. The outcome of debate should be agreement based, but it is often open to disagreements between factions. The participative aspects of decision-making exist alongside the bureaucratic components in schools and there is often tension between these models of management. These approaches may be difficult to sustain, because principals remain accountable to external groups, and participation can only be established with the support of the principal. The effectiveness of this system depends on the staff - if they actively participate, it may succeed (Bush, 2006).

#### ***2.8.4 School-based management (SBM)***

According to Caldwell (2005, p.1), “school-based management (SBM) is the systematic decentralisation to the school level of authority and responsibility to make decisions on significant matters related to school operations within a centrally determined framework of goals, policies, curriculum, standards, and accountability”. School transformation is about decentralisation as a policy framework within which schools are expected to work in a more transparent and accountable way. Decentralisation policy and its implementation strategy of SBM, focus on change and outcomes (Marishane, 2013). Although the notion of SBM is often highly contentious, school leaders should ensure that the attention of the teachers stays focused on learning outcomes for learners and this must remain the central concern. In return for gaining greater authority to manage its own affairs, it is expected of schools to show how well they are doing in addressing the goals of the school system. If there is to be success for all learners at all times, then schools must have a capacity to measure how well learners are doing, and report on the outcomes. Continuous lifelong learning is a precondition for accreditation (Caldwell, 2005). SBM has been

evident in policy and practice for more than three decades, but it is in the 21<sup>st</sup> century that many countries are implementing decentralisation policies aimed at meeting the needs of a transformed society (Marishane, 2013).

SBM is capacity building, a process of increasing the focus on instructional goals and outcomes by improving the capacity of teachers to work together. It has a structural component, but a culture that focuses on continuous improvement, is the main agent of change. It succeeds when it contributes to problem solving and mobilisation of the efforts of all stakeholders (Fullan & Watson, 1999). SBM is not just a structural or educational reform. It must focus on the support of trained teachers, the fostering of leaders, and the availability of learning materials. Parent and community involvement in decision-making and implementation are a means to better education and a critical component of local development (Fullan & Watson, 1999). Other elements that are required are decentralised management, accountability for decisions and actions, school-based human resources development and the creation of a sense of purpose in pursuit of quality education (Marishane, 2013).

Under SBM, different areas are decentralised to the school to improve education. These areas include physical, human and financial resources, power, knowledge and skills, time, technology and information, the school's active involvement in self-improvement activities, forging external relations between the school and community, and internal links within the school. SBM is informed by national education policy guidelines and the school formulates its own internal policies through its governance structures. The school assumes responsibility for establishing committees and systems to manage key performance areas. Guided by national strategic plans, the school develops its own vision and mission, objectives, mechanisms of measuring performance and responsibilities of various school-based structures. The self-managed school exercises its decision-making authority in matters relating to staff, finance, learners, infrastructure, assessment, curriculum and instruction (Marishane, 2013).

Central initiatives may be determined at the national, provincial or district levels, and school leaders should have the capacity to respond to these initiatives. Forces driving the move to SBM include the demand for less control, reducing the size and

cost of maintaining a large bureaucracy, the commitment of empowering the community, and the desire to achieve higher levels of professionalism (Caldwell, 2005). Schools need to develop plan-driven budgeting to ensure that high priority learning needs are addressed. For teachers, SBM constitutes professional development dealing with assessment, curriculum design and research-based pedagogy. For principals, community building, strategic leadership, planning, human resource management, policy-making and resource allocation are important. These needs give rise to a new field of knowledge management in schools. Intensive use of ICTs at a school will aid the effort (Caldwell, 2005). When schools in a system where SBM has been implemented, are working together in networks, the opportunity for learning across the system is enhanced. A combination of top-down and powerful lateral networks enhance the possibilities of transformations and sustained change across all schools (Caldwell, 2005).

SBM will not deliver all the expectations of school reform. When implemented under the right conditions, it is one of several strategies to be addressed simultaneously that involve different levels of governance in a school system (Caldwell, 2005).

### ***2.8.5 Living Lab methodology***

The Living Lab approach is an example of a participative management approach and shared leadership. The introduction of new technology led to changes in management practices in these institutions. Living Labs is recognised internationally as a methodology and an approach to introducing innovation that works well in a multidisciplinary context in various settings, such as urban and rural environments. It allows all stakeholders – government, society, industry and academia – to achieve their own goals and outcomes in support of a specific community. Users and citizens become active participants in experimentation and testing during projects, and not merely passive receivers of innovation. All parties stand to gain through equal partnerships in the process (CSIR., 2009).

In an African context, a key dimension in Living Labs is the rural community perspective. Africa has particular challenges in relation to rural socio-economic development and sustainable quality of life, due to the current state of available infrastructure, educational and employment opportunities and resultant migration of

the youth to urban environments, as well as international emigration (Cunningham & Herselman, 2012). Living Labs Networks in Africa provide an important opportunity to collaborate, co-create and test new products and services, technologies, processes or business models customised for developing markets. Living Labs in South Africa that have been successfully running for several years include: Siyakhula Living Lab, Reconstructed Living Lab and Emmanuel Haven Living Lab (Cunningham & Herselman, 2012).

Numerous ICT for Development (ICT4D) interventions working towards socio-economic development of marginalized communities are currently being undertaken. Innovation within ICT4D must be driven by grassroots impetus to ensure sustainable, relevant and context-driven outcomes at community level (Gumbo, Thinyane, Thinyane, Terzoli, & Hansen, 2012). Important key factors are external resources and expertise, the need for meaningful engagement with the end-user community in developing solutions, and the importance of empowering the communities with the tools and skills to facilitate self-actualization and appropriation of technology to their needs (Gumbo et al., 2012).

The Siyakhula Project was launched in 2005 as a large collaborative project between Rhodes University, the University of Fort Hare, industry, government and community. This is a Living Lab, focussing on the collaboration of multiple stakeholders (government, industry, research institutions and communities). These stakeholders form a public-private-people-partnership to create mass impact and address societal challenges. This collaboration is an essential element to allow research insights and innovation opportunities to be exchanged and validated. From a community perspective, the Siyakhula Living Lab (SLL) provides opportunities for marginalised people to begin participating in the knowledge economy. It also provides a unique opportunity for researchers to undertake practical research that can have a positive impact on rural South Africa. It provides government with a platform to work towards service delivery in under-served areas and from an industry perspective, participants are afforded the opportunity to test ICT infrastructure in a rural context. Industry's social responsibility arm can be extended towards improving the human resource skill and towards uplifting neglected communities (Gumbo et al., 2012).

The communication platform supports the marketing of local arts, craft and eco-tourism through e-commerce and e-health, e-government and e-learning. Local wireless connectivity, a connection to the internet and ICT training form integral components of the Living Lab. The Living Lab empowers the rural communities and also channels the innovative potential into general national systems of innovation.

The growth of the SLL and the increasing number of role players added complexity to its management. A structured management has been established to make use of the outcomes that are already achieved and make it possible to achieve the short and medium term goals of the SLL in an efficient manner. Difficulty in fault diagnosis, hardware failure and social factors are reasons for lengthy downtimes. A certain degree of computer literacy and competence are required to accurately diagnose network faults. Training was undertaken with community members on basic fault diagnosis. Environmental conditions like irregular power and inadequate earthing of network equipment were found to be the source of some hardware failures. This project is concerned with financial, technical and cultural sustainability (Gumbo et al., 2012).

The Living Lab for Innovative Teaching Research at the University of Pretoria (LLITUP) was established in 2014. It developed for a variety of reasons that included the need for an environment where lecturers, post-graduate students across subject fields and other developers of innovative teaching, can share ideas, support and resources, the need for training in new developments in ICT for education, and to make a difference in the academic careers of learners from areas ranging from the most affluent to the most under-developed (Callaghan, 2012).

The aim of LLITUP is to contribute towards the task of addressing educational challenges in the unique South African context. Pressing challenges include the fact that many learners are unprepared in key subject areas and a high percentage of teachers and school managers are underperforming. Lecturers and students also face a highly demanding environment, where the rate of change and development in available tools and the prolific adoption of these technologies by the millennium generation, create opportunities as well as challenges. Interventions often do not reach the most remote and disadvantaged areas in the country, where the need for educational support and innovations are great. The LLITUP centre is unique in the

South African context as a result of its interdisciplinary, integrated and cooperative approach, the Living Lab focus, which implies innovation and sustainability, and the multi-disciplinary collaboration opportunities (Callaghan, 2012).

## **2.9 Conclusion**

In this chapter, the importance of strategic management was discussed. It was concluded that leadership and management are not the same, but that they are linked and complementary (Kotter, 2013). School leadership to maximise the effectiveness of ICT integration was discussed, because leadership is highlighted in the literature to be the key for successful ICT implementation (Seong & Ho, 2012). Systems thinking was identified as the management approach in this study. Matrix management was proposed as the theoretical framework. The criteria, types, advantages and disadvantages of matrix management were discussed. In a matrix in a school environment the SGB, principal (general manager), HODs (functional managers) and project managers play important roles. Other models worthy of consideration were also investigated. While formal models like bureaucracy dominated the early stages of the development of management theory in education (Bush, 2006), today, no single perspective has prominence. This is because organic leadership requires a complete shift in thinking and is defined by concepts like trust, mutual respect and the acceptance of the on-going process of organisational change (Avery, 2004). Distributed leadership, falling within the organic paradigm, and collegial models, part of the distributed framework, were discussed. School based management, where school leaders should ensure that the attention of the school community is focussed on learning outcomes for learners (Caldwell, 2005), was also discussed.

In chapter 3, the research design and methods are presented. The unit of analysis was matrix management. The study is discussed as a qualitative descriptive case study. The participants in the study are discussed, as well as the interview, document analysis and field notes as data collection strategies. A qualitative descriptive data analysis, the methodological norms and ethical procedures are presented.

## Chapter 3: Research design and methods

### 3.1 Introduction

The purpose of this chapter is to discuss the design of the study. The research was designed to answer the main research question: What are the key managerial challenges faced in implementing an ICT network that involves a network of schools? The interest of this study then was to describe the key managerial challenges faced in implementing an ICT network that involves various schools.

This part of the study provides a description of the methodology used in the study. It includes the paradigm, research approach, population, sample size, instruments, data collection methods, data analysis, methodological norms and ethical issues.

Given the philosophical basis of this study, I have designed my research as a qualitative, descriptive case study, using open-ended interviews, field notes and document analysis as data gathering techniques. Because of my previous encounter with the research site, I had pre-knowledge that influenced the choice of research design. Some of the facts that I had to take into consideration include:

- that the IWB network created a matrix management system, specifically multiple reporting lines in all six schools involved;
- that multiple role players are involved, and that the principal plays the major decision-making role in the matrix;
- that the multiple reporting lines caused conflict, stress and confusion to those involved in the network;
- that matrix management systems are vulnerable to constant changes;
- that there are also other challenges encountered in the network;
- that the matrix management system allowed for professional growth and development for all involved, but that the workload of teachers increased;
- that the network contributed to the motivation levels of learners and teachers;
- that there are different types of matrices, but a balanced matrix developed in this project.

In the light of this pre-knowledge, I chose a design that would enable me to interact with the role players on a one-to-one basis through interviewing. A qualitative research approach was therefore apposite.

### **3.2. Epistemology and ontology**

Ontology is concerned with claims about the nature of being and existence (Hammond & Wellington, 2013). My ontological stance is social constructivist; therefore I recognise the importance of social context for cognitive development. Social constructivism is based on assumptions about reality and social constructivists believe that reality is constructed through human activity. In the management of this project, the SGBs, principals, project managers, HODs and teachers are constructing the reality. Reality does not exist prior to its social invention (Kim, 2001), and individuals create meaning through their interactions with other people and their environment. Meaningful learning takes place within an individual when he or she engages in social activities (Kim, 2001).

One could also argue that man is an active constructor of reality and therefore creates the environment, and situation in which he finds himself. The IWB network is the creation of the stakeholders and to understand the creation, one needs to understand the thinking that went into the network, the design, implementation and management challenges of what was created. We invent concepts or schemes to make sense of experience and continuously modify these constructions in the light of new experiences (Schwandt, 2007). The constructivist researcher in this study provided information about the background of participants and the contexts in which they were studied.

Social constructivists assume that people develop subjective meanings of their experiences and that they want to understand the world in which they live and work (Creswell, 2009), and, as a result, a key characteristic of research is reliance on the participants' views of the situation being studied. I used open-ended interview questions so that the participants could freely share their views about the management of the study.

Epistemology refers to what we believe about how we come to know and understand the world (Hammond & Wellington, 2013). For the purposes of my research I approached the problem from a subjectivist epistemological stance. Knowledge is a human product, socially, internally and culturally constructed and therefore subjective. The knower cannot be separated from the known.

### **3.3. Choice of paradigm**

Ontological and epistemological assumptions make up a paradigm (Mack, 2010). A paradigm is a view of the world and a framework of beliefs, values and methods within which the research takes place (Hruskin, 2002). It is the way people think and how they want to know, the way they wish to make sense and analyse, their assumptions about life (Glaser, 2004). The naturalistic paradigm assumes that the goal of researchers is to understand how individuals construct their own reality within their social context. There are multiple interpretations of this reality. The knower and the known are interactive and inseparable. Inquiry is value bound and it is impossible to distinguish causes from effects (Lincoln & Guba, 1985). Naturalistic inquiry seeks accurate description of the action in terms of knowing and is cognisant of the difficulty of generalisation. What naturalistic research wants to discover, is contextual findings and not sweeping generalisations. Naturalistic inquiry's meanings come from description of joint researcher-participants interactions (Glaser, 2004).

In my study, I uncovered the beliefs of the participants, and the narratives of the interviewees provided insight into their experiences. I revealed power relationships by looking at the management structure that developed in the different schools. My study occurred in different schools and the intent was to search for meanings in specific cultural and social contexts (McGregor & Murnane, 2010).

### **3.4. Qualitative descriptive approach**

This was a qualitative study. Nieuwenhuis (2007, p. 51) describes qualitative research as research that studies people or systems by interacting with and observing them in their natural environment, with the intention of describing and understanding the phenomenon by "looking through the eyes" of the participants, so that the meaning can be described in terms of the meaning that phenomena have for the participants. The emphasis is on the quality and depth of information.

The natural environment of the participants consisted of the different schools I visited. These schools ranged from a richly resourced school in an Mpumalanga town, to a farm school in the rural area, with the distances between them ranging from 10 to 50 kilometres. I met with the school principals in their offices, and they organised my meetings with their staff members and SGBs. I met with the HODs and staff members either in their classrooms, offices, or an open space indicated by the principal. When I interviewed the staff, they did not have any learners in front of them, although some open or office spaces were very near to classrooms, making it difficult to hear what some of the interviewees had to say. At the leading school, I met all participants in their boardroom, a space very conducive to meetings, with large tables, proper space to set up the video camera, comfortable chairs and away from the hustle of school life. I met some of the SGBs in the principals' office, some in other offices at the schools and one I met at his shop in town.

The research design is based on the researcher's assumptions, research skills and practices, and influences data collection (Nieuwenhuis, 2007). I asked all participants questions from an interview schedule, but they were free to elaborate, or even change the flow of the discussion. In this way, I ensured that my perspective of the phenomenon was through the eyes of the participants. I ensured that I had an in-depth discussion about the management model, approach, challenges, changes and critical incidents in the project. My empathy towards the participants was expressed by my reassurance that they could reveal anything to me without the fear of being identified, and I showed great interest in the influence of this project on their daily lives.

The qualitative researcher's task is to find patterns in the words and actions of participants and present those patterns while staying close to the participant's world (Siegle, 2002). The concern with context is one of the most important aspects of qualitative research, thus the participant's view of their world has to be seen in the socio-cultural and historical context of the network. Human experience is shaped in specific contexts and cannot be removed from them. We cannot understand the realities of a lived situation until we appreciate its embeddedness in a variety of settings. Qualitative approaches are based on a holistic "worldview" that believes there is no single reality, that multiple realities are constructed by the participants

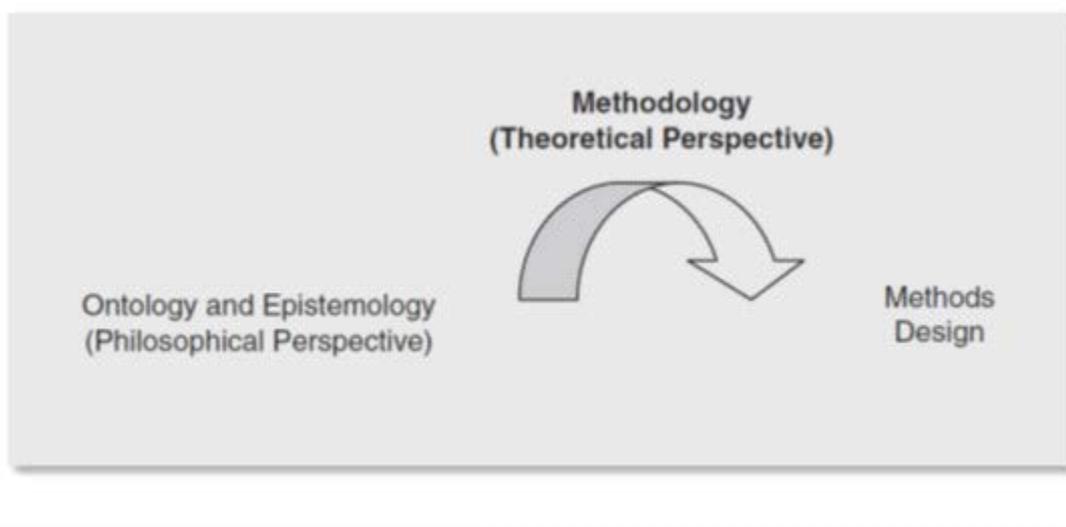
and described by the researcher (Lichtman, 2010), that reality changes over time and is based upon different perceptions for each person, and that what we know only has meaning within a given context (Joubish et al., 2011). The reasoning process involves putting pieces together to make wholes. Meaning is produced from this process, but because perception varies individually, many different meanings are possible (Joubish et al., 2011).

In this study, the context was an experience with new technology, specifically interactive white boards and a networked internet connection. This was a new world to the rural schools, as they did not have any experience with technology before the project. It had a different effect on different teachers. It affected the teachers of the leading school, because they have to plan the lessons. Although they have lots of experience with technology, they had to learn how to share their content with others as effectively as possible. The rural school teachers had to learn to work with the technology in their own classes in order to optimise the benefits to their learners. They are responsible for copying notes before transmissions, setting up the classrooms, ensuring discipline, as well as motivating their learners to take part during the transmissions.

Qualitative research attempts to be as naturalistic as possible, meaning that contexts must not be modified (Kincheloe, 2012). Such research is conducted in the natural setting for which the study is proposed. Participants are recruited and studied in their day-to-day environment (Keele, 2011). "Thus, qualitative research attempts to appreciate human experience in a manner empathetic to the human actors who feel it or live it" (Kincheloe, 2012, p. 188). *"The qualitative realm is intensely concerned with studying the holistic experience of consciousness and its relationship to social, political, linguistic, cultural, and economic practices in the world"* (Kincheloe, 2012, p.190). A holistic approach pays attention to the connections between the philosophical framework and the method used (see figure 3.1), integrates ontology, epistemology, methodology and method and can be thought of as the research nexus. Research is viewed as a process, not an event. Adopting a holistic approach means that the researcher views as interrelated all research choices, from topic selection to final representation (Hesse-Biber & Leavy, 2011).

I adopted a holistic approach in the sense that I chose this topic when it was a pilot project, and kept contact with some of the participants in the research setting for a further five years. I was aware of the grade 12 Science and Mathematics results achieved at the inception of the project, as well as accolades achieved by the leading school as a result of this project. I decided to conduct further research because of my interest in this case's achievements.

**Figure 3.1: Methodology: A bridge between philosophical framework and methods design**



Taken from: (Hesse-Biber & Leavy, 2011)

Four characteristics are identified as key to qualitative research: "the focus is on process, understanding, and meaning; the researcher is the primary instrument of data collection and analysis; the process is inductive; and the product is richly descriptive" (Merriam, 2009, p.14).

In my study, I was the primary instrument of data collection and analysis: I conducted the interviews on my own and proceeded with a verbatim analysis of the interviews. I also conducted an analysis of field notes and documents, to which I got access through the project's administrative officer and the representative of the Mpumalanga Department of Education. The focus of the research was on the management process, namely planning, organising, staffing, leading, controlling, motivating, and co-ordinating, as well as on understanding and meaning: I developed an understanding of the system followed in this project and derived meaning from the words and gestures of the participants. I worked inductively. I assumed, for example,

that other projects of this type would follow the same management model and approach and would undergo the same changes and challenges as described in chapter 4. I produced a richly descriptive product in the data analysis in chapter 4.

Qualitative research looks at cultural and social experiences, relationships between occurrences and the significance of events as they affect specific human endeavours (Kincheloe, 2012). I searched for socio-cultural and historical patterns. Culturally, two of the principals and two of the teachers in the rural schools had a technological background. All the teachers indicated that they needed training in the new technology, and a few of them were afraid to use the technology in the beginning. Historically, the rural schools were disadvantaged in terms of internet access (it did not exist) as well as hardware and software. Most of the learners did not have any access to computers. The leading school, on the other hand, had a variety of technology available and their teachers became used to the new technology very fast, although they admitted that their learners are usually even more au fait with technology than themselves. In essence, the qualitative data provided the insight into the management challenges that developed in the IWB network.

One of the goals of a qualitative study is description. Good description is fundamental to the research enterprise (Hale, 2011). Descriptive research is not aimed at forming a hypothesis or development of theory, but is about describing reality through the eyes of participants. Thick description of an object or process is realised from a specific perspective. Descriptive research is making inventories; prescriptive research is normative (Lans & Van der Voordt, 2002b). Descriptive designs aim to gain more information about a particular characteristic within a field of study and to diagnose problems with practice. There is no manipulation of variables and no attempt to establish causality (Siegle, 2002). I did not formulate any hypothesis for this research study, but moved into the research with certain assumptions, mainly based on my previous encounters with the research site. I assumed, for example, that there are socio-cultural differences between the leading school and the rural schools, that the workload increased mainly for the teachers of the leading school, that the project introduced more positive changes than challenges, that most participants were very positive about the influence of the project in their schools, etcetera.

The purpose of descriptive research is to examine phenomena occurring at a specific place(s) and time. It is concerned with finding out “what is” i.e. relationships that exist, opinions held and processes or trends that are evident (Thomas, 2010). Description is used to organise the data that emerges during analysis into patterns. These patterns help the researcher to understand a qualitative study and its implications (AECT., 2001). In a descriptive study the data becomes useful for solving problems only when the process is guided by much thought, effort and specific research targets (MonroeCollege, 2011). Descriptive research studies require a clear specification of the who, what, when, where, why and how of the research. They refer to the following: who (principals, SGBs, HODs, teachers, project managers in schools), what (new technological intervention), when (since 2008 and on-going, with no end envisaged for the project), where (schools in an Mpumalanga town), why (to obtain better grade 12 results in Mathematics and Science and to bridge the urban-rural divide in South Africa), how (a network of interactive whiteboards, through which classes are transmitted from a leading school tot rural schools). This detailed description will take place in the data analysis.

Sandelowski (2000) states that qualitative descriptive studies are less interpretive than *“interpretive description”*. They do not require researchers to move far away from their data or provide an abstract presentation of data. They can produce a complete end-product in themselves, rather than being an entry point into other qualitative studies (Sandelowski, 2000). Sandelowski (2000) refers to qualitative description as basic or fundamental, entailing *“a kind of interpretation that is low-inference, or likely to result in easier consensus among researchers”*. Therefore, researchers should agree on the “facts” of the case, which are described in an everyday language. Events in proper sequence must be conveyed by these descriptions. Descriptions depend on the perceptions of the describer, and entail researcher’s choices about what to describe. In this study, I used basic, but analytical description of the management system in everyday language and stayed very near to the data collected. Although researchers can never describe everything that is “there”, most observers would agree that their choice of description is in fact “there” (Sandelowski, 2000). I specifically concentrated on describing the management challenges in an IWB network based on the critical incidents that occurred.

Some qualitative descriptive studies have narrative hues (Sandelowski, 2000). I received narrative descriptions through the semi-structured interviews from all participants about the history of the project, covering, for example, the earlier years when the project started, the challenges experienced at its inception, the sponsors that came on board and the different schools participating in the project. Qualitative descriptive research is characterized by emergent design, purposeful sampling, and data saturation, open-ended modes of data collection and textual analyses, all of which were used in my study. The value of qualitative description lies in the knowledge it produces as well as treating research methods as living entities that resist simple classification (Sandelowski, 2010). In my study, I am interested in the description of the management structures in a case that developed over a period of six years in a cluster of Mpumalanga schools.

The intervention in a few Mpumalanga schools established the whole project as a case, a small geographical area and a small number of individuals chosen. Yin (2009) defines case study research as an empirical inquiry that investigates a contemporary phenomenon with the boundaries between phenomenon and context not clearly evident, over which the researcher has little or no control and in which multiple sources of evidence are used. The IWB network in rural schools is a contemporary phenomenon. The researcher has no control over it and multiple sources of evidence were used. The boundaries of this case are the management challenges, the management model and approach and the influence of the different role players on the management of the network.

### **3.5 Case study design**

Case studies involve gathering a lot of information about a person, event or group occurring in the present to allow the researcher to understand how it functions (Berg, 2001). In this case study, I described the management challenges that occurred in an Mpumalanga IWB network and gathered a lot of information about a group of schools bound together in an interactive whiteboard network.

The unitary nature of an individual case is the focus of analysis and it is therefore essential to determine the unit of analysis before beginning the case study (Thomas, 2010). "The unit of analysis, *not* the topic of investigation characterizes a case study"

(Merriam, 2009, p.41). The unit of analysis in this case study was matrix management. The group of teachers, managers and SGB members involved in this network work in a bounded system, namely an IWB network between the participating schools. A case study is a choice of what is to be studied, a unit around which there are boundaries (a bounded system), for example one program, learner or classroom, selected on the basis of being intrinsically interesting, unique or typical (Merriam, 2009). The case is a bounded social system with interacting parts functioning as a whole. The issue in this case is an exercise in management by those in control. The case is a specific integrated system. Certain features are within the boundaries of the case, others are outside (Stake, 1994). Some of the features outside the bounded system may be significant as context, for example the school administration may have an influence on the project.

Only certain schools are involved, namely six participating schools in Mpumalanga, 30 interviewees were involved- 6 principals, 6 HODs, 9 teachers, 5 SGBs, a project manager and project organiser, an administrative officer and a representative of the MDoE. The teachers are Mathematics, Maths Literacy and Science teachers for grade 12, and some of their input was also derived from the learners in their classes. Also involved in the bounded system is technology (IWBs and computers), the management model and approach, changes and challenges encountered, and critical incidents. Aspects outside the bounded system, that may influence the project, include schools in Mpumalanga and South Africa not involved in this case, other types of technology, for example mobile phones, other teachers in the participating schools who teach different subjects, learners taking other subjects and school administration.

This is a single case study design, an example of school innovations in which individual schools adopt an innovation, in this case the IWB network. The data collection sources are individuals (for example, interviews with the principals, SGBs, HODs, project leaders and teachers), whereas the unit of analysis is organisational (matrix management). Even though the data collection relies heavily on information from interviews with individuals, the conclusion cannot be based entirely on this. I collected information from individuals' reports about the organisation, but also used field notes and documents as sources of information.

This is an intrinsic case study and the particular case became interesting as a result of its uniqueness (Berg, 2001). The selection of the sites in this study was straightforward because I have chosen to study a unique case, the identity of which has been known to me from the outset of the inquiry and I had a special arrangement for access to the sites (Yin, 2009).

Yin (2009) emphasises that the need for case studies arises out of the researcher's desire to understand complex social phenomena and that the case study allows investigators to retain the meaningful characteristics of real-life events. In my study, the school is the real life context as the participants are naturally found in this setting. Yin (2009) identified exploratory, explanatory and descriptive case studies. In a descriptive case study, the researcher needs to present a description to establish the overall framework to follow throughout the study and it is necessary to identify an applicable theoretical framework before articulating the research question(s). I identified matrix management as a theoretical framework for this study. In this type of case study, the researcher attempts to conceptualise a phenomenon and recreate the context (Thomas, 2010). Yin presented four applications for a case study model, of which two apply in this study, namely the description of the real-life context in which the intervention has occurred and the description of the intervention itself (Yin, 2009).

According to Zainal (2007), the case study "allows the exploration and understanding of complex issues" and is a "robust research method, particularly when a holistic, in-depth investigation is required". It enables the researcher to investigate contemporary real-life phenomena for the purposes of understanding, and to examine the data within a specific context, such as a small geographical area or limited number of participants. Case studies observe the data at the micro level (Zainal, 2007). In this study, I used 30 participants and explored the management challenges in depth on a micro level in six schools in an IWB network in Mpumalanga.

Qualitative case studies can be described as particularistic, descriptive and heuristic (Merriam, 2009). Particularistic means that the case focuses on a particular phenomenon, like the management challenges in an IWB network. Descriptive means that the end product is a rich, thick description of the phenomenon (Merriam,

2009), and the researcher describes the complexities in situations as they occur in a real-life environment (Zainal, 2007), for example, the different strategies that were used by managers to handle conflict in the management of an IWB network. A heuristic study illuminates the researcher's understanding of the phenomenon. In a case study the investigator assumes that human behaviour is situation specific, but there is also a predictable uniformity in basic human nature (Thomas, 2010).

Although case studies have various advantages, for example that they allow for greater depth than is possible with other data collection methods (Cohen & Manion, 1995), and that they are valued for their ability to capture complex action and interpretation (Merriam, 2009), they are also criticised for not being able to generalise results, lack of rigour and the tendency for a researcher to be biased. Generalisation is not a goal of case studies; discovering the uniqueness of each case is the purpose (Hays, 2004). Generalisation was not the intent of this study; I wanted to describe how people's practical experiences developed a management system that can address their day-to-day challenges.

Rigorous research must be transparent and explicit, meaning that researchers need to be able to describe what they did in clear, simple language (Ryan, n.d.). To establish rigour in qualitative research, researchers have to ensure the credibility, dependability, confirmability and transferability of the research. These characteristics will be described under the methodological norms in this chapter. Data collection and analysis are both subject to the researcher's characteristics and background. The researcher must describe in detail how the research results were arrived at, and sufficient evidence must be provided as to why possible alternative interpretations are rejected, so that rigour is established and bias limited (Darke, Shanks, & Broadbent, 1998). The researcher's beliefs, values and assumptions may prevent adequate investigation and consideration of possible contradictory data. I chose this case study as a result of my previous encounter with the network. I do not believe that this clouds my investigation, because earlier, I was asked to evaluate the pilot project, whereas now I have studied the management challenges of the network. I used multiple sources of evidence (triangulation of the data) and I attempted to describe the situation from the participants' perspectives (Darke et al., 1998). I specifically took contradictory data into consideration.

A substantive case report should contain the following: a) an explanation of the problem, b) a thorough description of the context, c) a thorough description of the processes relevant to the problem, observed in the context, d) a discussion of those elements identified as important that are studied in depth, e) a discussion of the outcomes of the enquiry, which may be thought of as the lessons to be learned from the study (Lincoln & Guba, 1985).

## **3.6 Research methods**

### **3.6.1 Introduction**

Research methods refer to the set of investigative procedures used within a particular field of study. In the everyday usage of the term in qualitative studies, method refers to a procedure, tool or technique used by the researcher to generate and analyse data (Schwandt, 2007).

### **3.6.2 Participants**

The Mpumalanga project consists of six schools in an IWB network. Together, they constitute the case to be sampled as they form a bounded system to be studied. The schools constitute the sample, but each has its own set of individual characteristics. In each school, I interviewed a member of the SGB, the school principal, the project leader (if the school employed one), HODs and staff members participating in the project. Here, I employed criterion sampling. Criterion sampling means that the researcher selects cases or individuals that meet a certain criterion (Given, 2008). I selected participants per school that are directly involved with the project (the criterion) to invite them to participate on a voluntary basis. Each of the selected participants had a role to play that made their inclusion apposite. I interviewed 30 participants in six schools: six principals, five SGB members, six HODs, nine teachers, the project manager and a project organiser, an administrative officer and a representative of the Mpumalanga Department of Education (MDoE). The teachers and HODs were interviewed because they were teaching Mathematics, Mathematical Literacy or Science in the IWB network. The principals, SGB members, HODs, project leaders and administrative officer were interviewed because they were part of the management of the IWB network. The MDoE was involved in a monetary capacity at the beginning of the project. Now the MDoE still provides paper

and pays the salaries of the teachers. The aim was the saturation of data by involving all those that could shed light on the phenomena under investigation.

### **3.6.3 Data collection strategies**

Data collection in qualitative descriptive studies is directed towards discovering the who, what, where and when of events or experiences (Sandelowski, 2000). I used semi-structured interviews, field notes and document analysis as data collection strategies.

#### **Semi-structured interviews**

Semi-structured interviews were used as the primary strategy for data collection (Hoepft, 1997). Interviews were held with the six principals of the six different schools in the IWB network, as well as SGB members, the project manager and coordinators, HODs, teachers involved in the project, and a representative of the Mpumalanga Department of Education. The researcher asked questions from an interview guide, designed prior to the interviews, as indicated in Appendix A. In the interview guide, I asked questions about the management and reporting lines, managerial challenges, the management roles and influence of the different role players in the project, supervision and monitoring of teachers, the contribution of the project to the specific school, possible disruptions or problems as a result of the project, opportunities for professional growth and other teaching benefits, the motivation of the teachers and learners, the mission and vision of the schools, possible advice to other schools, and the future of the project.

The interview guide is a list of general questions that the interview wants to explore and, with it, I was allowed access to the participant's perspectives. It was prepared to ensure that basically the same information was obtained from each person, but I also used probes within these predetermined inquiry areas (Hoepft, 1997), and the flexibility in the questioning allowed each participant some control over deciding what aspects of the phenomenon are most important according to their experiences (Shah & Corley, 2006). I entered the study in an emergent way, with an open-ended or natural attitude (Lincoln & Guba, 1985). The literature that I consulted regarding matrix management served the purpose of uncovering typical challenges, pitfalls and successes associated with the matrix management system. It provided me with the

necessary background to steer the interviews in such a manner as to touch on these challenges and opportunities. I used my theoretical framework as a point of departure to establish if a matrix management system developed in the different schools, and if so, of what type.

Qualitative interviewing assumes that the perspectives of others are worthwhile and knowable. We interview to gather other people's stories (Patton, 2002). According to DeMarrais (2004, p. 52) "qualitative interviews are used when researchers want to gain in-depth knowledge from participants about particular phenomena, experiences or sets of experiences". By using questions and probes, the goal is to construct as complete a picture as possible about the experiences of an informant and to discover that person's view of a phenomenon (DeMarrais, 2004), in this case the management of the IWB network. An interview is a conversational process in which a researcher and participant engage, focused on questions related to a research study. The questions ask the participants about their thoughts, opinions, perspectives and descriptions of specific experiences (DeMarrais, 2004). The respondent is asked to participate in this conversation with the researcher. The interview thus becomes a unique form of discourse between two people, in which interviewers can develop a dialogic relationship based on mutual trust, where self-disclosure and equality are promoted (Delamont, 2012). Each interview experience is filtered through a unique set of experiences, beliefs and assumptions about the research topic (DeMarrais, 2004), from the researcher and participants alike.

I held semi-structured interviews with the principals to find out how they saw the project in the beginning, how they handled the management in their schools, whether their opinions and management changed, and how. What was of specific importance was to focus on critical incidents that posed particular management challenges, how these were addressed, and to identify challenges that are enduring. I also held semi-structured interviews with the project manager, a project organiser, members of the SGBs, HODs, staff members and a representative of the MDoE to pursue the same challenges from their perspective. The process was therefore iterative. Participants' opinions, experiences and feelings about the management and the challenges to management were explored. In-depth interviews were used to collect different perspectives on the topic. As new ideas emerged, they were further pursued until

data saturation was achieved (Creswell, 2009). When data is saturated there will be no more flow of new information, but just repetition of the same information.

Social phenomena are understood at the level of individual subjectivity and expressed in life stories (Ryan, 2006). Narratives aspire to capture the experience as it was 'lived' through rich description and interpretation (Simons, 2009). According to Kramp (2004), understanding, rather than explanation is the object of narrative inquiry. The researcher using narrative inquiry respects the storyteller's use of context (time, place, plot and character) to situate particular experiences, so the narrative structure reflects the participant's life, as experienced. The narrator not only tells the story from a point of view, but also situates it in a social, cultural or political context. Narratives enable the storyteller to organise the story by linking events, perceptions and experiences (Kramp, 2004).

I stayed in the Mpumalanga town for four days and made appointments with the different schools. On day 1, I left Pretoria early and visited disadvantaged school 1, where I had made an appointment for 12:00 to see the principal. I was welcomed by the secretary, and the principal made time to see me immediately. It was clear that he handles the reins of authority firmly and competently, since, amongst other things, the learners were neat and behaved well. I conducted a comprehensive interview with the principal, and I learned that his school does not have any project manager or coordinator for the ICT initiative. He then took me to the class of the Mathematics teacher, who told me that he usually reports to his principal directly, and sometimes to the HOD for matters pertaining to the FET curriculum. After this interview, the principal took me to the class of the Mathematics Literacy teacher. She was of the opinion that nobody at her school is supervising the project, since she reports directly to the leading school. I went to the shop of an SGB member of the school, after I called to make an appointment on the principal's advice. He has a child in the primary school, and was not aware of the project running at the school, but he gave me the number of another SGB member, whom he thought would know more about the project than him. I called this SGB member as well, only to find that he was also not aware of the project, despite the principal having told me that the SGB is budgeting to put more IWBs in the school.

On the second day, I visited the leading school early, at 8:00. I was accommodated in the boardroom, and the administrative officer organised all the interviews. All the participants came to see me in the boardroom when they could take time off from their school schedule. I interviewed the project manager first, who answered my questions comprehensively, and also gave me a narrative account of the history of the project. The second person I interviewed was the HOD of Science. She stated that she is the only one in her subject responsible for the project, and that she is just managing herself in regard to the project. The Science teachers in the other schools report to her in their subject group meetings. Next, I interviewed the HOD for Maths. She was asked by the project manager to handle the transmissions for Maths because her learners had achieved a 100% pass rate for several years. She is also only managing herself with respect to the project. I then interviewed the administrative officer. She works mainly with the marks from all schools, but also ensures that the yearly plan is in place, that the rural schools receive their notes and that the transmissions are taking place. According to the Mathematics Literacy teacher, they do not have to do any reporting. She said that, at the beginning of the year, the teachers meet in subject groups and discuss the topics for the year, and then she puts the planning for her subject onto the system. The principal of school 2 reckons that it is necessary to set up a project structure to handle the e-learning project. It is important to budget to keep the project manager in a permanent post, to do ongoing training, to get funding from the private sector and to find a balance between what your needs are and what is affordable. I did not interview a member of the SGB, because the project manager stated that they merely gave the green light for the project and are not continually involved, although he gives regular feedback to them.

At 12:00 on day 2, I visited school 3, where I interviewed the principal first. He manages his responsibilities as principal by walking around and being a visible presence. It is clear that he knows his teachers and learners and that there is very good discipline at his school. They formed a committee at their school to handle the project. Since this project is being implemented specifically in the FET phase, the teachers report to the HOD of FET and to him. He invited the other participants to his office, where I could interview them in a quiet environment. Next, I interviewed the HOD of Maths. She explained her role as moderating common tests after the

teachers marked them. In their school, the original coordinator of the project has been promoted to a different position, and so now they report directly to the administrative officer in the leading school. The Science teacher's interview confirmed that they report internally to the HOD and principal and externally to the LS. Next, I interviewed the HOD for Languages, who is also involved in the project, occupying the role of the IT specialist. He said that they work on any problems in collaboration with the LS. They use IWBs in other phases as well. The principal made an appointment for me with the chairman of the SGB, whom I interviewed the next day, again in the principal's office. He reiterated the important role of the principal, and how they work together as a team.

On day 3, after I interviewed the SGB of school 3, I visited school 4 at 9:15. I interviewed the principal first. He also arranged his office as a venue for all the interviews to take place. He is very positive about the project and is amazed that their children, most of whom do not even have TVs, are getting exposed to a world of knowledge. He had attended a few principals' meetings and stated that all the principals are positive about the project. The SGB chairperson sat at the back of one of the classes during a transmission, and he finds it mindboggling that the learners have access to knowledge in such a way. He is very thankful towards the leading school for initiating the project and sharing the educational benefits of technology with his school. Next, I interviewed the HOD of Maths Literacy. She has to log in to receive the transmissions, but is also the only teacher from the rural schools responsible for delivering some transmissions. It is very clearly communicated to her a long time in advance when she has to prepare lessons. She does not report to anybody except the principal in her school, and only the PM and the AO monitor her performance. The Maths Literacy teachers from the other schools report to her in subject meetings. The project coordinator at school 4 is also a member of the SGB. He is of the opinion that this project is helping to standardise the quality of education and is putting them all on the same path. As a member of the SGB, he claims that the SGB bought into the concept.

I visited school 5 at 12:30 of the same day. Again, I interviewed the principal in his office first. He stated that the educators in the project report to him, but mostly to the LS, because this is where the information is kept. He is of the opinion that the

principals should be brave enough to allow the project in their schools and he highly appreciates the sponsors of the school. I interviewed the next three teachers in a small office in the front of a classroom. It was difficult to hear the participants, as a result of the noise coming from the class. The Science teacher said that he works with minimal supervision, but he reports to his HOD and principal. His opinion is that the project necessitates work beyond the call of duty and this requires the participation of committed educators. The first Mathematics teacher said that she is not supervised; they coach one another and work together. They just take care of their classes and ensure that the work done is in line with the cluster. The second Mathematics teacher said that his role is clearly defined; he must just ensure that his class pay attention to the teacher doing the transmissions. He sets his own goals, but must submit his marks to the HOD and LS. The principal made an appointment for me to see a member of the SGB the next day.

On day 4, I visited school 6 at 8:00 in the morning and interviewed the principal in his office. He defines the roles of the teachers in his school, together with the program leaders of the LS. He is very thankful to the sponsors who invested in their school and reckons that the most important impact of the project was the improvement in results. When one looks at the results in subjects that are said to be complicated, these are now the best performing areas in the school. He also mentioned that, for several weeks, the transmissions were unavailable to his learners due to the internet cables being accidentally cut during building operations in the school. The Science teacher is the project coordinator and he has to ensure that the network is working and that they get transmissions from the other side. I interviewed him in his classroom. He is of the opinion that the training received by the teachers was inadequate and that the project requires a continuous learning process. A member of the SGB was on the premises looking at the building operations, and I had an opportunity to interview her immediately. I interviewed her and two Maths teachers in an open office space between two classrooms. The classes made a lot of noise and it was difficult to hear the interviewees. The SGB member is of the opinion that the SGB gave approval for the project in the school. She said that they need more money because there are only four classes with internet access. They also do not have laboratories, but through the internet, learners can see necessary experiments. According to the HOD of Maths, the ICT is managed like any other learning area.

The project has its own programme, and it sometimes differs from the work schedule of the Department. I interviewed a Maths teacher at school 6. He sees his responsibility as ensuring that everything is working according to the DoE and e-learning work schedule, and his HOD and the LS monitor his performance.

After that, I went back to school 5 to interview a member of the SGB. He felt that the project was at first a scary thing, but once one is involved in it, it gives one the motivation to work on it and gain more experience in it. The results of the school improved drastically for this reason. After this interview, I went back to Pretoria to continue with the transcription of the interviews and field notes.

I sent an email to a representative of the Mpumalanga Department of Education with the interview questions I wanted to ask. He answered my questions in a comprehensive manner. He is of the opinion that the success of the project depends entirely on the efforts of able, willing and motivated teachers. The MDoE stressed that the project must be integrated with the on-going operations of the schools.

### **Document analysis**

Another invaluable source of information for qualitative researchers is document analysis (Hoepft, 1997). It is the systematic exploration of written documents or other artefacts. In pedagogic research, the contents, and not the style, of documents are of interest (Thomas, 2010). Such data for this network included web sites, newspaper accounts, reports on the progress of the project, photos of learners who obtained bursaries as a result of this project, and learners' marks. Document analysis enables the researcher to sift through a large amount of data in a systematic fashion. It allows one to ascertain the focus of an individual, group or institution. The content of documents was explored systematically to look at themes related to the research questions. It was used together with the interviews to develop a better understanding of the phenomenon of interest and its context (Shah & Corley, 2006). Documentary evidence reflects communication between other parties attempting to achieve objects other than those of the case study. Constantly trying to identify these objects makes it more likely that the researcher will be critical in interpreting the contents of the evidence (Yin, 2009). If used to triangulate, results of the document analysis may complement or contradict other data (Thomas, 2010). Robson (2002) in Thomas

(2010) points out that advantages of document analysis are that it can be used without imposing on participants and that they can be checked and rechecked for reliability. A major disadvantage is that documents are not written for the same purposes as the research and therefore conclusions cannot be drawn from document analysis alone.

From the administrative officer, I obtained documents containing the Science, Mathematics and Mathematics Literacy results of the previous few years. The representative of the MDoE provided me with more documents on the project, namely a document on “Ways of learning”, a completed SWOT analysis of the project and a transformation agenda of the South African Teacher’s Union in Mpumalanga. In addition, I have in my possession planning and budgeting documents dating from the pilot project. I analysed the documents, looking for the objectives of the project and the academic results for the years 2008 to 2013. In the SWOT analysis, I could compare the challenges (weaknesses, threats), strengths and opportunities experienced early in the project to those of the current scenario. I could compare the transformation agenda of the province to the impact of the project on the participating schools.

### **Field notes**

Field notes are notes created by the researcher to record and remember things like feelings, behaviours and activities of an interview or observation setting (RWJF, 2008). I made field notes after the interviews and kept the research questions in mind when making them. I jotted down descriptive information like the physical setting, the participants and their roles, and the meaning of what was observed from the perspectives of the participants, as well as reflective content like criticisms and insights about what I heard (Libraries, 2014). The preliminary analysis of the field notes revealed self-reflection and emergent themes (RWJF, 2008). I put my notes into context so that I could understand them later. The field notes were transcribed into summaries.

Semi-structured interviews, narrative accounts, field notes and document analysis were used to triangulate the data to enhance the credibility of the study.

### **3.6.4 Data analysis**

According to Yin (2003), descriptive investigations call for some theory to determine the priorities of data collection. One cannot collect information about everything, and the investigator without a descriptive theory will encounter enormous problems in limiting the scope of the study (Yin, 2003). My theory was that a matrix management system would develop in all six schools investigated around the interactive whiteboard network. I would then describe what management model or models developed, what the management challenges in these models are, what critical incidents occurred, and what contributions the lessons learnt from this case study could have towards management theory.

According to Thorne (2000), qualitative researchers are interested in uncovering knowledge about how participants think and feel about their circumstances and they do not judge whether these thoughts and feelings are valid. Data collection and analysis processes tend to be concurrent. This means that the theoretical lens through which the researcher approaches the case, the strategies that he or she uses to collect data, and the understandings that the researcher has about what counts as important in answering the research questions, are all factors that influence the data (Thorne, 2000).

Data analysis in qualitative research does not use pre-existing codes for sorting data, but it always has a focus, driven by the research questions. If the data points in a different direction, openness to reassessment of the focus exists (Elliott & Timulak, 2005). Data is usually in the form of notes and tape recordings, as it was in this study.

I recorded all the interviews and then transcribed them verbatim. I read the entire data set several times to obtain a complete picture of the management challenges, management approach and critical incidents as seen through the eyes of the participants. I omitted obvious redundancies and repetitions. Thereafter, the data was divided into meaning units i.e. segments of data, communicating sufficient information to be understood and meaningful even if read out of context (Elliott & Timulak, 2005). The analysis is done using the meaning units, although the researcher needs to be able to trace them back to the full interviews or field notes.

I used Atlas.ti for the analysis of the data. First, I opened a new hermeneutic unit in Atlas.ti, called “Rural Management”. Then I imported all the transcribed interviews into Atlas.ti and marked all the recurring ideas. I then, through open coding, created a lot of codes, under the subtitles Changes (for example Different teacher, Different methods, Vision and mission, Teacher motivation, Learner motivation), Challenges (like Money, Maintenance, Increased workload), Goals (Better results, Bursaries, Bridge the urban-rural divide) and Roles (Principal, PM, AO, HOD, LS). As each code is created, the programme uses it to detect the relevant content in the interviews, which is then tagged with the code name. In this way, it is easy to find what different participants said on different topics and to copy and paste that portion of the interview in the data analysis.

I created a printout of all the codes to calculate the number of times each code occurred and to establish which codes were most important. Then I created code families, putting the codes belonging together under the same subheadings, for example Equipment challenges, Learner Changes and Challenges, Network Changes, Management Changes and Challenges. It is possible to find different kinds of relationships between families, for example chronological or causal. In this process, meaning units are constantly compared to each other and to emerging categories. I looked for similarities or differences between the already established categories (Elliott & Timulak, 2005) and it was necessary to redefine the meaning units when similar meanings were incorporated from new meaning units.

After this, I created networks, namely Management Changes, Management Challenges, Critical Incidents - Positive, Critical Incidents - Negative - Human, Critical Incidents - Negative - Non-human, and Management Model and used these to create figures 4.3-5.1.

It is also good practice to look for negative cases in qualitative analysis. These are responses or events that contradict the main findings. Then you need to re-examine the data and try to explain why something has happened in such an atypical way and modify your ideas (Taylor, Gibbs, & Lewins, 2005). I also created an output report in Excel which notes the frequencies of the use of all the codes as related to each

document (Archer, 2013). The purpose of counting of data in qualitative research is to render a description of the patterns or regularities in the data (Sandelowski, 2000). Description thus stays close to the data as originally recorded and addresses the question: What is going on here? (Simons, 2009). This is what I did in my study.

### **3.6.5 Methodological norms**

Qualitative researchers refer to research as being trustworthy and credible, while quantitative researchers use the terms validity and reliability (Nieuwenhuis, 2007b). The basic question addressed by trustworthiness is how the researcher can convince his or her audience that the research findings are worth paying attention to (Hoepft, 1997). The researcher, as data gathering instrument, enhanced the trustworthiness of the study. The interviews were recorded and none of the responses were altered. Transcription was done as accurately as possible. In order to ensure that study findings were trustworthy, the researcher shared extracts of the field notes and emerging findings with participants (Delamont, 2012). This is called member checks, the idea being that one asks for feedback on emerging findings from some of the participants (Merriam, 2009). A draft version of the research was sent to the administrative officer and project manager of the leading school, the representative of the MDoE and principals of the rural schools after data analysis.

The quantitative principles of validity and reliability cannot be addressed in the same way in qualitative research. Trustworthiness in qualitative approaches to data analysis consists of evidence of four characteristics, namely: i) credibility; ii) transferability; iii) dependability; and iv) confirmability (Lincoln & Guba, 1985), and if these principles are taken care of, it contributes to the rigour of the research.

The naturalistic researcher assumes multiple realities and attempts to represent them adequately. Credibility is the test for this (Hoepft, 1997). To ensure that research is credible, the researcher needs to provide assurances of the fit between participants' views of their life and the researcher's reconstruction of it (Schwandt, 2007). The careful selection of a case is considered as the first step towards credibility in case study research (Wahyuni, 2012). I chose a case rich in data and with different participants, based on its uniqueness in the South African environment. I reconstructed the participants' views and asked a selection of the participants if

they agreed with the reconstruction. Credibility is used to check how accurate data collection and analysis procedures were undertaken to address the intended research focus (Graneheim & Lundman, 2003). According to Patton (2002), credibility does not depend on sample size, but on the analytical abilities of the researcher and the richness of information. This case had 30 participants that provided rich information on especially the management challenges and approach at six different schools. The researcher used data triangulation, described the interviews verbatim and used Atlas.ti in the analysis process.

Credibility can be enhanced through triangulation. "The researcher makes inferences from data, claiming that a particular set of data supports a particular definition, theme, assertion, hypothesis, or claim. Triangulation is a means of checking the integrity of the inferences one draws" (Schwandt, 2007). There are four types of triangulation, involving the use of multiple a) data sources, b) investigators, c) theoretical perspectives, or d) methods. In this study I used data triangulation, through obtaining data from different sources, namely semi-structured interviews that were recorded and described in a narrative format, field notes and document analysis. Using different sources of evidence is a major strength of case study data collection and then findings are more convincing. It allows the researcher to address a broad range of historical, attitudinal and behavioural issues (Yin, 2009). Triangulation is necessary "because research is a process of discovery in which the genuine meaning residing within an action or event can be best uncovered by viewing it from different vantage points" (Schwandt, 2007).

In the naturalistic paradigm, transferability depends on the degree of similarity between the original situation and the situation to which it is transferred (Hoepft, 1997). It is a process performed by readers of research (Palmquist, 2011). The researcher has to provide readers with sufficient information so that they can establish the degree of similarity between the case studied and a possible case to which findings might be transferred (Schwandt, 2007). To do this, readers need to know as much as possible about the research situation to determine if it is similar to their own (Palmquist, 2011). In the findings chapter, I am going to give a rich and thick description of the research site, the management challenges and the type of

management system and approach developed in an Mpumalanga IWB case study in order to provide as much information as possible on the research setting.

In order to address the dependability issue, the processes within the study have to be reported in detail, to enable future researchers to repeat the work, although not necessarily with the same results (Shenton, 2004). Several interpretations of the same data can be made, and it will stand until contradicted by new evidence. If the findings of a study are consistent with the data presented, the study is considered dependable (Merriam, 2009). Dependability is focused on the inquirer's responsibility for ensuring that the process was logical, traceable, and documented (Schwandt, 2007). In chapter 4, I will describe the findings and ensure that they are consistent with the data found in the interviews and documents, so that the process is logical and traceable.

Researchers need to create an audit trail to show the thinking behind their description of the participants' accounts of their world. The researcher's personal reflection, insights and biases are acknowledged. I produced an audit trail and acknowledge that I subjectively looked for certain management challenges and approaches that developed in the IWB network. In the audit trail, I described in detail how data were collected, how I derived the a priori and emergent categories, and what decisions I made throughout the inquiry. I kept a research journal with personal notes on the process of the research as it was undertaken.

The concept of confirmability is the qualitative researcher's concern with objectivity (Shenton, 2004). Steps must be taken to ensure that the findings are the result of the ideas of the participants and not the preferences of the researcher, or figments of her imagination (Schwandt, 2007). The role of triangulation in promoting confirmability is very important, in this context, to reduce investigator bias (Shenton, 2004). I also described the interviews verbatim and use the participants' words in the findings.

### **3.7 Research ethics**

Ethics is how we should behave in relation to the people with whom we interact. This means establishing a relationship with participants that respects human dignity. If any issues arise, these have to be resolved, addressing participants' concerns and meeting the researcher's obligation to produce public knowledge (Simons, 2009). My

focus was case study research, where people and their experiences are faithfully described. I had to ensure that I did not misuse information or exploit participants' openness or vulnerability (Simons, 2009). I adhered to the ethics principles as described by the University of Pretoria. No fieldwork was conducted before permission was granted by the Ethics committee of the University of Pretoria. Permission to work in the schools was obtained from the Mpumalanga Department of Education (See Appendix B). Written informed consent was obtained from the voluntary participants (Appendix C). All participants were above the age of 18. The participants' confidentiality and anonymity were guaranteed at all times. Pseudonyms were used for the participants to guarantee the confidentiality of the findings. The principle of trust was adhered to, meaning that respondents were not subjected to any acts of deception or betrayal in the research process. No incentives were used and no secret research was undertaken.

### **3.8 Conclusion**

This chapter paid attention to the research design and methods followed in this study. The difference between ontology and epistemology was described and the research paradigm followed in this study was described from the naturalistic stance. I discussed and justified my choice of a qualitative descriptive approach as the most suitable approach for this case study. The Mpumalanga project consists of six schools in an IWB network and they constituted the case that was sampled. Criterion sampling was employed when I interviewed members of the SGBs, the school principals, the project manager, HODs, staff members and a representative of the MDoE participating in the project. I selected participants per school that are directly involved with the project (the criterion) to invite them to participate on a voluntary basis. Data collection strategies (semi-structured interviews, narratives, field notes, and document analysis used for triangulation) and data analysis were described. The methodological norms were identified and trustworthiness was explained in terms of credibility, transferability, dependability and confirmability. Lastly, research ethics was unpacked.

In chapter 4 I will describe the whole project in terms of the management system designed in the schools and I will distil and discuss the management challenges from the interviews.

## **Chapter 4: Data analysis and Findings**

### **4.1 Introduction**

This study focused on how the project was handled by the management of each school individually and between the schools, what they thought about it and how they succeeded in inspiring their teachers to be part of it. The purpose of my research was to determine the key managerial challenges in implementing an ICT network in a cluster of schools. I wanted to determine the critical incidents that occurred during the life span of the project that had an effect on the management of the project and how the various stakeholders influenced the outcome of the crisis. I concentrated on how managers handled possible conflict that developed between various role players in the network and asked them to supply reasons for such conflict if it developed. I wanted to determine the type of management approach that developed during the implementation of the ICT network and the possible management models that were used in managing an ICT network involving numerous schools.

### **4.2 Context of the study**

In 2007, the project manager made a presentation to the Mpumalanga Department of Education (MDoE) to obtain funding to start a pilot project transmitting grade 12 Mathematics and Science lessons between the leading school and other schools. They started transmitting in April 2008. The e-learning project originally started as a school community project where the leading school transmitted Maths and Science lessons to rural, disadvantaged, underperforming schools. The e-learning started with user desktop sharing as well as the interactive whiteboards with videoconferencing. The MDoE helped financially to set up the system in 2007-2008, but since then, the schools have been dependent on sponsors. As the technology changed, they changed the camera systems to use less bandwidth, and increased the internet data size to all schools, so that the learners can use it for research as well. Two dependent schools are in town (within a radius of 10 kilometres from the leading school), and three schools are within a radius of 50 kilometres of the leading school. Two schools are combined schools, with primary and secondary learners, two schools are secondary schools and one is an agricultural or farm school. The leading school installed IWBs in all the schools, even, in one school, for grade 1 to

grade 7 learners. Lesson presentations, tests and exams are shared on the server and used by all schools. In 2013 they started transmitting to grade 11 Science and Maths classes.

As a result of this network, the results of the learners of the rural and township schools started improving, as well as the overall pass rate per school, and learners obtained bursaries for more distinctions. Due to topic discussions with teachers, the teacher training programme also became more effective. During the October holiday schools, all grade 12 learners receive summary notes of the grade 12 work. The project manager says that they would like to start transmitting Maths and Science lessons for grade 10s as well.

According to the representative of the MDoE, the project has reached capacity. They cannot add more schools because funding is getting scarce; time is a problem and schedules in rural schools have become tight. The project can expand with respect to content and subjects taught. In terms of management, he thinks they could have done better during the early days, but this is a new way of thinking and doing. Technology changes every day and maintenance of the system is very difficult without a budget from the MDoE.

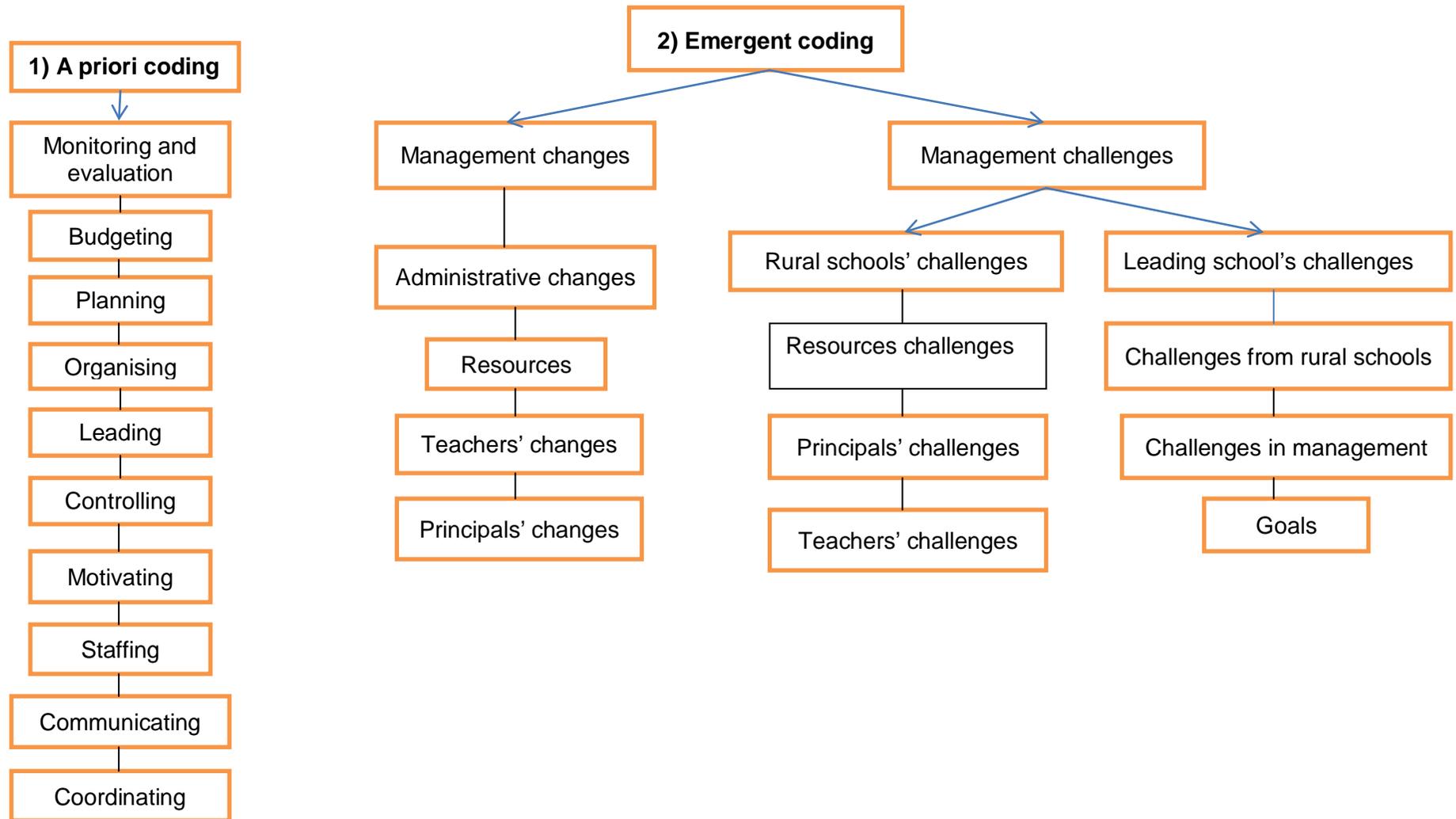
### **4.3 Analytical framework**

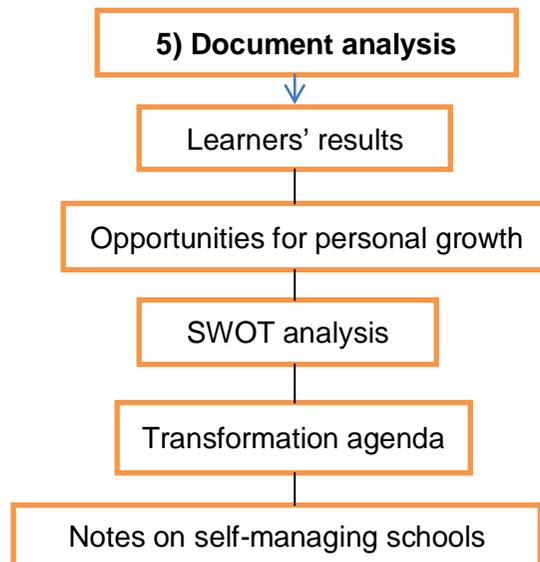
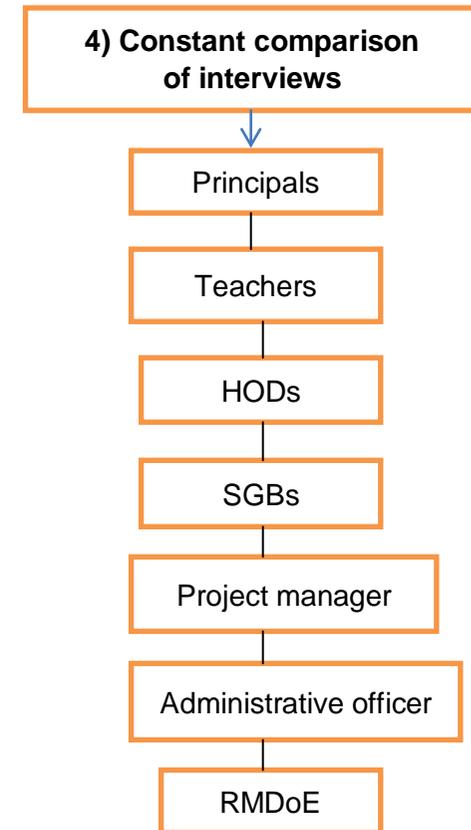
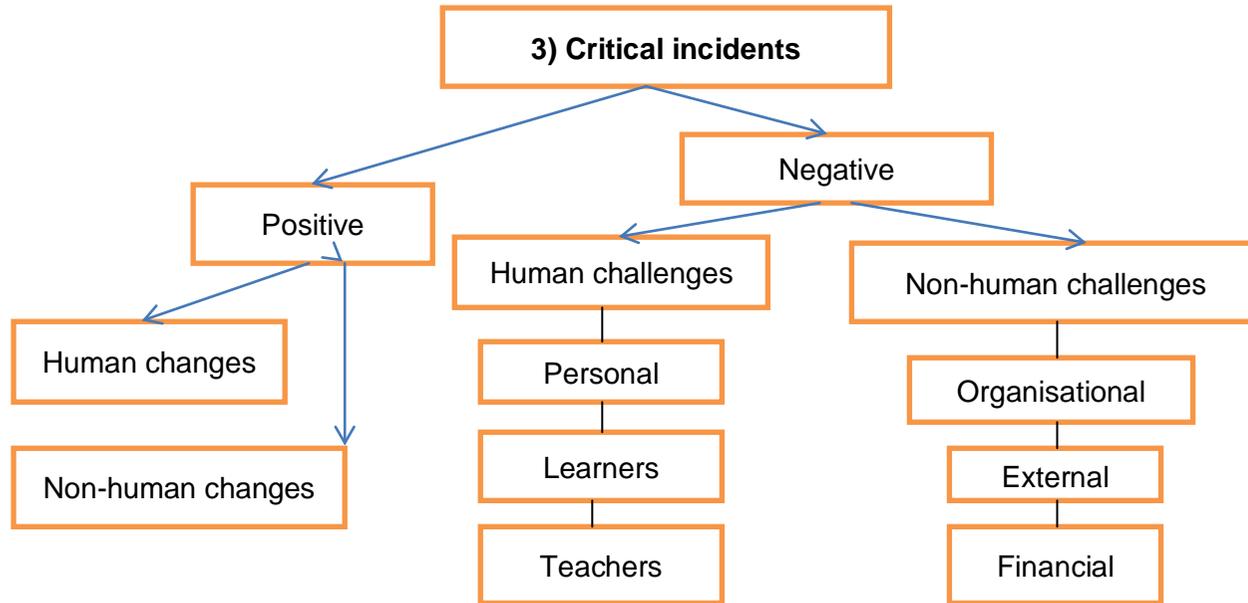
The analytical framework described in this chapter consists of a priori and emergent coding, as well as a description of the critical incidents that occurred in the project, a constant comparison between opinions expressed in the interviews regarding the management of the project, and the document analysis.

Under the a priori coding, the monitoring and evaluation that is done by the MDoE is discussed, as well as the different managing processes like budgeting, planning, organising, directing or leading, controlling, motivating, staffing, communicating and coordinating. Under emergent coding, the management *changes* that occurred are discussed first, divided into administrative changes, resources, teachers' and principals' changes. A discussion of the management *challenges* in the project follows. The challenges in the rural schools are divided into principals' challenges and teachers' challenges. The challenges of the leading school are clearly split into challenges reported by the rural schools and challenges occurring in the

management of the project and goals set for the project. The positive critical incidents that occurred in the project are divided into non-human and human changes. The negative critical incidents are divided into human challenges, where personal challenges, learners' and teachers' challenges are discussed, and non-human critical incidents, where organisational, external and financial challenges are discussed. A comparison of the interview responses with regard to the management of the project follows, where interviews with principals, teachers, HODs, SGBs, the project manager or coordinator, the administrative officer and a representative of the MDoE are described. In the document analysis, learners' results, opportunities for professional growth, a SWOT analysis, a transformation agenda and notes on self-managing schools are discussed. This analytical framework is depicted in figure 4.1.

**Figure 4.1: Analytical Framework**





#### 4.4 A priori coding

One of the sub questions of this research project asked the following:

*What are the possible management models that may be used in managing an ICT network involving numerous schools?*

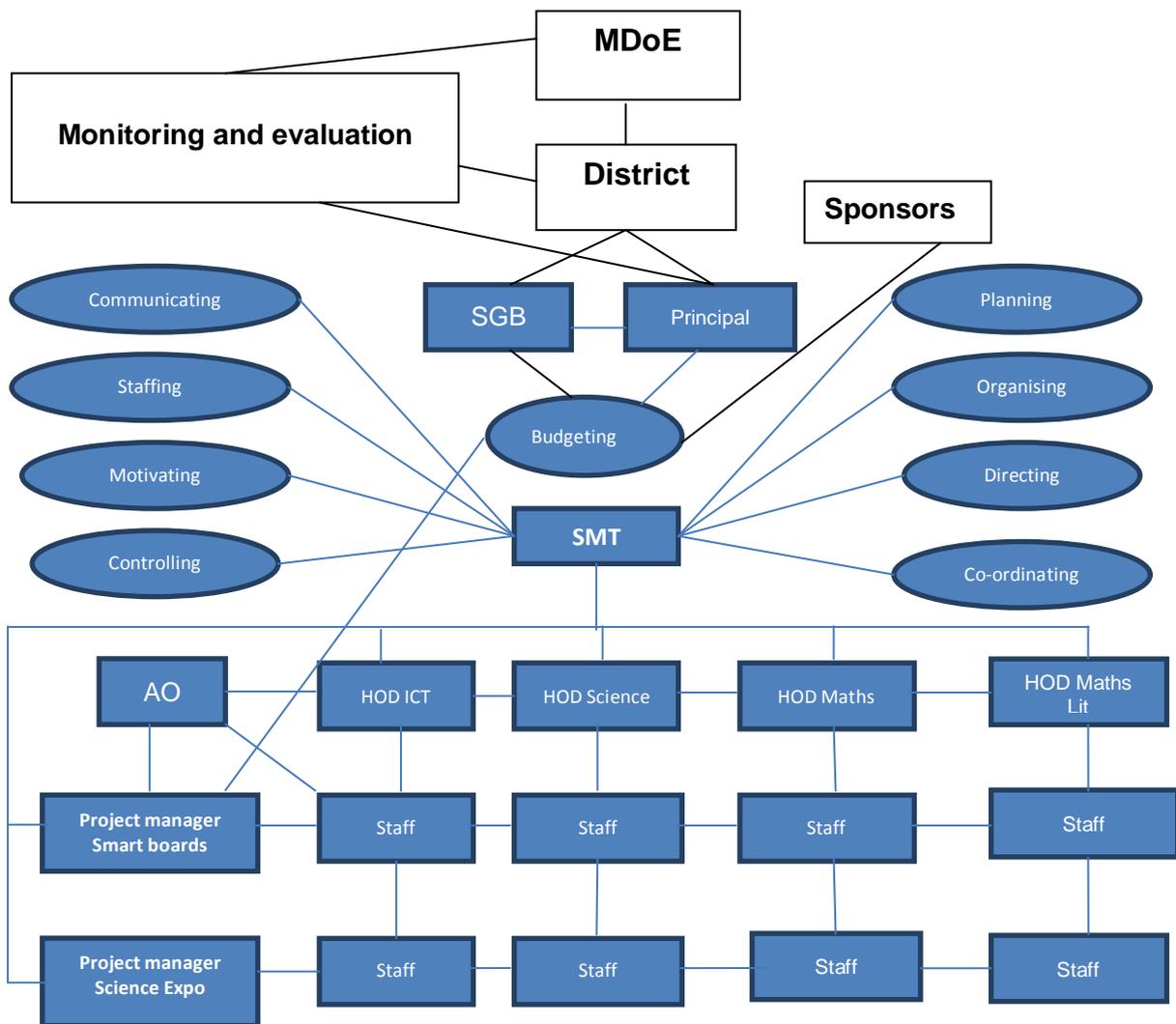
My first assumption was that, in this case, the cluster of schools set up a matrix with a project manager to take care of the ICT smart board community network. Specialist teachers in Mathematics and Science are dedicated exclusively to this project and other closely related projects such as Science Expo's.

Figure 4.2 illustrates the complexity of the management structure of an ICT project. Each school has its own internal management structure, with its own SGB and principal, who will need to take decisions pertaining to the financial implications of the project, while the project manager is responsible for the sponsors. The SMTs are in charge of the other management functions. Cutting across this, is the ICT project that involves a number of schools, some with their own project manager. This structure is typical of a balanced matrix structure, where all the teachers report to at least two managers - the functional (HOD) and the project manager.

The matrix management model as discussed in chapter 2 is made applicable to my own research in figure 4.2. The MDoE is outside the matrix and responsible for **monitoring and evaluation** of the project. The MDoE initiated an auditing of the pilot project by the University of Pretoria. The representative of the MDoE suggested that a steering committee should plan the project work and budget. At the beginning of the project, all the reports came to the project manager of the leading school, who handled all the management, like installation of hardware and software, upgrades, training, meetings, administration, and finding sponsors. Since 2009 however, the school has appointed more staff to help him, the most important being the administrative officer, appointed in January 2011, as well as technicians and an IT administrator. MDoE: *“Establish a SteerCom representing all stakeholders and: 1) agree on the deliverables and expectations; 2) plan the project/work and document the project properly; 3) secure the budget – budget is a killer assumption; 4) work the plan and ensure the plan is working; 5) deliver the expected results; 6) learn from the experience.”*

The project must follow the pace setter of the Department during curriculum planning and assessment. According to the project manager, the leading school just helps the rural schools to stay on track with the Department’s pace setter. PM: *“In the Department all the teachers have their own pace setters, so what we do from the project's side, we just take that same pace setter and we just actually help them to stick to the same pace setter, because a lot of time you find it is difficult the situation in which the teachers are. They have a lot of children, so maybe they can fall behind with their work, so with the project we help them. So there we come in and just try to help them to stay on track.”*

**Figure 4.2: Illustration of the matrix management structure of an ICT project**



Adapted from: <http://kalyan-city.blogspotcom/2010/06/management-functions-process-management.html> (Akrani, Katyani, & Patil, 2010) and (Edgeli, 2007).

The SGBs and principals in each school are in charge of the **budgeting**. It is clear that the budget for model C schools is very tight and that one has to plan the expenses properly. The project manager of the leading school is in charge of the sponsors, and they have a huge positive role to play in the project.

This has been explained by the project manager in the following terms: *“My own role at the moment is to go out and get sponsors, to get this project going, and to give feedback to the sponsors. They always want feedback. They want to know how things are going, so my own role is clear.”*

Ralph (one of the rural school principals) says: *“May I start with the sponsors, who are dear to my heart. Their positive attitude to a previously disadvantaged school has created an atmosphere conducive for learning, for even the most rural school,”*

One of the challenges with the budgeting is that every school is waiting for the project manager to secure sponsor money, while the SGBs have a very limited budget to use. The SGBs are budgeting for things like paper, security and upgrades, while the sponsor money is paying for the IWBs, computers, extra paper and maintenance.

**Planning**, a primary function of management is the starting point of the management process and all other functions are related to and dependent upon it. It is about where the organisations are going and how they will get there. Planning is concerned with the future and flexibility is the key feature. In this case, the principals plan how ICT will be introduced and developed in each school and who will be responsible for the project. They also plan the timetables of their schools and they need to fit the twice-weekly transmissions, from 8:00am to 9:00am into the grade 12, and one day into the grade 11, timetables. The rural school principals plan around a shortage of classrooms, teachers and IWB classes. They plan the distribution of computers between teachers and learners. The project manager of the leading school plans for the training, updates on the network, maintenance, upgrades, technical support and the use of sponsorship money. The administrative officer plans the quarterly meetings and the yearly plan. She ensures that she receives the marks from the rural schools by sending a worker from her school to collect them. The HODs of the leading school plan the transmissions and the common assessments, as well as the subject meetings with teachers in their subject field. The teachers are planning for

the re-teaching of learners after the transmissions where it is necessary, finishing the grade 12 syllabus in time, coping with the extra marking load as a result of the common assessments, as well as creating extra opportunities for the learners in the IWB classes.

**Organising** means to bring the resources together and use them properly to achieve the objectives. The IWBs are installed in all the networked schools and new and updated software and upgrades are continually used, with all teachers undergoing training in the hardware and software. Organising defines the role each member of an organisation needs to perform and determines the relationships between such members. The teachers are in charge of their classes when the transmissions take place and they have to mark the common assessments. They report to their HODs, principals and the project manager and administrative officer of the leading school. The HODs of the leading school are in charge of the subject meetings and transmissions and they report to their principal and the project manager and administrative officer. The HODs of the rural schools moderate the marks of the teachers reporting to them and they report to their principals and the project manager and administrative officer of the leading school. The administrative officer handles the marks reports of all schools and is responsible for the statistics. She works together with the project manager on the quarterly meetings and yearly plan. The project manager is in charge of the e-learning project office and is responsible for finding sponsors. He gives feedback to his SGB and principal, while the IT administrator and technicians report to him on maintenance and technical support.

Organising is concerned with determining the specific activities needed to accomplish planned goals. In schools, the SGB and principal are responsible for the governance and budgeting. The SMT is responsible for the management functions as indicated in figure 4.2. The members of the teaching staff at schools are organised into departments according to subject areas, with the HODs in charge, and specific duties are assigned to these departments. Duties concerned specifically with the project are delegated to the project manager.

**Directing or leading** deals with instructing people in the right way and is the responsibility of managers at all levels, in this case the principals, SGBs, HODs and project manager. Leading is about identifying a vision and mission for the school,

improving the instructional programme and building a relationship with the community. It is about delegating assignments and applying schedules, about making decisions and getting things done. The principals in this network play a very important role. They are the top leaders in the schools and must set the stage, determine the standards of expected performance and delegate duties. They ensure that the mission and vision of the schools are in line with the use of ICT. If they were not positive about the project in their schools, it would not succeed, because they are in charge of the functional and horizontal reporting lines. They have to make the right decisions so that goals can be achieved effectively. The SGBs take the lead in budgeting. The project manager of the leading school wields a lot of power because he is in charge of an e-learning committee, consisting of himself, the administrative officer, technicians and IT manager, who all report to him. All the teachers report their marks to the administrative officer. The HODs, project coordinators and teachers report to the principals of the various schools. The teachers also report to the HODs in their subject groups.

**Controlling** is necessary with regard to both individuals and departments, so as to avoid wrong actions and activities. It encompasses the assessment and evaluation of tasks, since managers have to evaluate how well an organisation is achieving its goals before striving to improve the performance of individuals, departments and organisations. As a result of the project, the teachers are doing more common assessments. This means that all the schools in the project are writing the same assessments in Mathematics, Science and Mathematics Literacy in addition to the assessments coming from the Department. This contributed to an increase in workload for all the teachers. Robert (a teacher of one of the rural schools) says: *“I can say yes, because there are different evaluations on the time table, so I can say that sometimes the Department of Education want this week the test must be written, so we need to mark the trial. Maybe the same week also there are waiting a test for this e-learning, so the marking, I have many classes, so we have to mark, the test for e-learning and we have to mark the test for the Department of Education. So I think basically the workload is more on the marking but not on the teaching.”*

The standard of the marking of the common assessments written in the project is evaluated by the HODs in their subject groups. The marks reports go to the administrative officer, who is responsible for the statistics measuring the progress of

the different schools over the years. The principals have to evaluate whether the teachers, project coordinators and HODs are doing their jobs to an adequate standard and that the project objectives are met, as well as whether teachers are taking ownership of the technology in their classes.

**Motivating** is the action in which a manager persuades his staff to give their best to the organisation. It means to encourage people to pay more interest to the work assigned to them. Staff members, through training, have become more computer literate, can access a lot of information and explore electronic media. As a result, they are motivated to integrate the IWBs into the curriculum. Teachers are working together, keeping the attention of the learners in class, and motivating the learners themselves to use new and different methods and to derive maximum benefit from the use of the IWBs. The AO is of the opinion: *“Definitely, you can see that the teachers are much more motivated because now they keep the attention of the children in the class”*.

Wilma (one of the HODs of the leading school) says: *“and then they are motivated to do it in another way. They also come and tell me they didn't know you can do it in this way or that way”*.

Ben (principal of one of the rural schools) says: *“and it also motivates the teacher to do that work more thoroughly, so that when the time of the lesson comes, her children do not stand back for the other children”*.

Max (teacher of one of the rural schools) says: *“we are now able to access information easily with the programs that are installed on the computers, so our teaching is now more interesting and we are greatly motivated”*.

Learners are motivated to learn further, they are more interested in Maths and Science and the subjects become easier for them, they want the IWBs in other subjects as well, there is less absenteeism, they like the other teacher teaching them, and the interaction with other learners, they can grapple with the problems together, they participate more in class and it is easier to visualise things.

Eddy (rural school principal) says: *“Look, learners get motivated, because it is something new..... today's children are into technology. When they see this, the eyes open up, they get interested into the lesson”*.

Billy (rural school principal) says: *“Yes, there was a big motivation from both sides because you would have loved to see these kids whenever they are busy with this e-learning and look into their interaction. It is completely different because they are aware they are competing with the other kids”.*

But it is not only the teachers and learners that are more motivated:

Wikus (the principal of the leading school) says: *“Yes, we got feedback from teachers as well as pupils, as well as people from the senior management teams, as well as the governing body members, and all in all, I can just say it just boils down to one big motivational situation where everyone that's engaged into this are really very positive, are really looking forward to a brighter future.”*

**Staffing** refers to the manpower required for the execution of the management plan and involves recruitment, selection, appraisal, remuneration, and development of personnel. Specific people in the school management need to decide what has to be done, assign activities to specific positions, and appoint staff who will carry out those activities satisfactorily. Certain staff members were recruited to teach in this network, mainly as a result of the subjects and grades that they teach, and they received some incentives like not having a class in front of them when broadcasting. All the teachers involved received training and each of them is of the opinion that this network helped with their professional development.

Wikus (leading school principal): *“you will see on the staff level you will find not only the staff really developed, and not only on their working skills, but also a change of mind, emotional changes, spiritual changes. So all in all there was a lot of development, but also on management level, we found that there was a lot of development for the head masters and senior staff members that was engaged. They all grew because they engaged in a very, very good structured project where there was good management. There was a good example set, of management.”*

Adam (rural school teacher): *“What I can say is maybe my teaching has improved in terms of how I present, what resources I have at my disposal to help learners to understand better.”*

Rudi (rural school teacher): *“I think that creates opportunities for professional growth because you can be able to venture into other career paths, which was not possible before. Without Internet, a lot of things do pass by without you knowing. With ICT you are able to come across this.”*

Emma (rural school teacher): *“I am teaching this particular topic that also makes me to explore and grow professionally. I use different methods.”*

**Communicating** is necessary for the exchange of facts, opinions, ideas and information between individuals and departments. In this project, the communication takes place mainly through quarterly meetings, where the yearly plan is produced, and where marks and goals, like a 100% pass rate and the obtaining of bursaries, as well as the learners' progress are discussed. The teachers also meet in their subject groups, where peer teaching and coaching are taking place, transmissions are discussed and potential teaching problems solved. There is a direct communication line to the administrative officer, who receives the marks, and the project manager of the leading school, in charge of maintenance, technical support and sponsors. Communication is essential for understanding roles, providing information and building positive relationships in this network. Clear communication is vital to the success of the project and leadership cannot exist without communication. Communication is a management function. The credibility of the leaders, namely the principal, project manager, administrative officer and HODs is the key to parental satisfaction and communication makes a substantial contribution to that credibility. The parents in this project support the schools and expect a lot as a result of it. Communication with the community is a key component of obtaining sponsorships. To supplement budgets with fundraising, clear communication is needed with parents and the community at large.

**Coordinating** is the synchronization of command structures to ensure that the resources of an organisation are used most efficiently in pursuit of the specified objectives (Business.com, 2005). In this network, the IWBs and computers are used to promote good teaching practice, to obtain better results which increase the likelihood of bursaries for the learners for further study, to promote further study for the teachers and to bridge the urban-rural divide. Coordinating integrates the activities of different departments and is essential for the orderly working of an organisation. In this case, it is the integrating of this network into the Mathematics, Mathematics Literacy and Science departments in the different schools. Some of the schools also integrated the IWBs into subjects like Life Orientation. The timetables of

the different schools are coordinated to facilitate the transmissions of Mathematics, Science and Mathematics Literacy for grades 11 and 12.

The representative of the MDoE sums it up as follows: *“to deploy good project management systems – planning; communication; reporting; monitoring; controlling; integration - the project must be integrated with the on-going operations of the school”*.

The end result is an overall ICT plan, organised, staffed, coordinated and controlled by the SMT. They have to communicate the plan to the staff and motivate them to be a part of it.

## **4.5 Emergent coding**

### ***4.5.1 Management changes in the network***

What emerged from the coding of the interviews were mainly challenges and positive changes in the network. The positive changes can be usefully divided into four categories: administrative, resources, teachers and principals, as indicated in figure 4.3.

Figure 4.3: Management changes in the network



Due to the commitment to change the timetabling in order to coincide with the timetable of the leading school, **administrative changes** took place, as depicted in figure 4.2. This project is functioning as a **learning exchange programme** between the different schools. All schools can see what one teacher or learner is writing on the IWB. All can benefit from the different teacher doing the transmissions and the different methods used during the transmissions.

Adri (rural school teacher): *“It is good that they experience another teacher, it is good that they are not only limited by my teaching. If there is something that I cannot get across to a specific learner, maybe this other teacher is aiding them in that way, maybe explaining something in another way that they didn’t get the whole year. So maybe it is a good thing that sometimes some other teacher will come in and re-explains something. It’s just better maybe, I think that is a good thing”.*

Teachers are getting together in subject groups, to exchange knowledge and do peer coaching. An **e-learning project office** was established to take care of the different reports coming from the rural schools about marks, technical support, maintenance, etcetera. In this e-learning office, are **support staff** like the administrative officer, technicians and IT administrator, taking care of the marks, computers and the network. In the quarterly **meetings**, the **yearly project plans** are discussed and the **infrastructure** determined. Infrastructure consists of things like project policies, processes, maintenance, equipment, servers, data and human resources, everything that supports the network. The PM is in charge of the infrastructure. According to the PM: *“The first thing is the infrastructure; it is a huge infrastructure in six schools so the infrastructure is actually the heartbeat of the whole project.”*

Although **meetings** may be seen by many teachers as a waste of time or have a negative connotation, 56 comments quoted from the responses of the 30 participants refer to meetings as being very positive in this network.

Secondly, according to figure 4.3, additional **resources** have impacted positively on the network. Sponsorships provide the financing for **technology resources** that are given to the rural schools, mostly IWBs and extra computers. 46 quotes from teachers and 23 quotes with reference to learners were positive about technology

use, as well as a further 25 about internet access. The leading school has a lot of resources and does not need any more IWBs or computers:

AO: *“At this stage, if you mean the technology at our school, it is sufficient at this stage. We are very privileged to have interactive whiteboards in all our classes, and every teacher and every school kid have access to the internet.”*

These resources need **upgrades** of the **hardware and software** every three to four years, and **maintenance** or **technical support** from the leading school may be necessary. The teachers are very satisfied with the technical support or maintenance that they receive from the leading school.

Adri (rural school teacher) *“Here and there, if there is a problem with the projector, you call them and they come the next day to fix it, that is not a problem.”*

Ben (rural school principal): *“When there is a problem, they try to resolve it as quickly as possible.”*

Tim (rural school project coordinator): *“they greatly support us, they send their maintenance people out to the school regularly, and they just keep the system going.”*

Rural teachers and learners now also have **internet access**, something that did not exist in the past and this is opening the world for them.

AO: *“What we usually do, or what we always do, is to install technology in these schools, because the rural schools do not have access to any technology, meaning computers, the interactive white boards, so now they are getting that all, paid by the sponsors, so they can just start giving class on that,”*

Robert (a rural school teacher) says: *“Yes, we must realise that this ICT is a tool in the hand of the teacher - a teacher tends to become more. They are very bored after 30 years of teaching, doing the same thing all over again, and I think the good thing of ICT education is that there are no limits. Every day you can find something new, might it be from the internet, might it be from the software we find on the smart board, but they look forward to the lessons because it is something new they can teach.”*

According to figure 4.3, it is clear that a lot of changes took place in the teacher environment. All the schools follow the **e-learning programme** drawn up by the leading school. This is a yearly programme drawn up in the beginning of the year, with 40 quotes to attest to its importance. The teachers doing the transmissions,

according to the representative of the MDoE, “*share quality teaching among the geographically dispersed classrooms, that had a marked improvement/impact in the **quality of lesson content and teaching methodology** of all teachers*”; “*I can say it was a continuous learning process*”, that is “**boosting of the standard of education**” (MDoE) and now “*even learners, they do enjoy to come to these classes because they've been exposed to **different teaching strategies and teaching styles***. (Emma, rural school teacher), *lesson planning improved, because there is pressure on teachers to perform; improved consultation; they have access to ICT networks and to good practice; sharing **good teaching practice***” (MDoE).

Teachers are exchanging information and using **different methods** and, according to Rudi (rural school teacher): “*If the lessons are being presented in five schools or six schools, it means we have six teachers who can be able to **exchange information***,” “*yet when I've been teaching a particular topic, I used one method, and now, when the broadcasting is done, maybe one other method that is different, you find even those that didn't understand earlier, they began to understand now the topic and I think it caters for different learning styles in a way*” (Emma, rural school teacher).

**Teaching and learning** is taking place: “*It is no longer one-way teaching where we feed learners with information, but with the smart board, learners can also be able to participate effectively, even though we don't have resources like laboratories. But with the smart board, because there are lots of experiments and, inside the system, learners are able to see more visual and interactive, the lessons are easier to present. You have various ways in which you can present a lesson*” (Rudi). PM: “*everyone receives the same notes and the same presentation so it makes the teachers feel more comfortable that all the children receive exactly the same quality of education*”.

**Peer teaching and peer coaching** are taking place in the subject groups. The HODs doing the transmissions are in charge of the subject groups and, in these groups; they discuss the common assessments and any problems arising from the network. This is one of the factors that are shaping **professional development**. Mandy (rural school HOD): “*Educators come together; they are making their plan, how to assist one another, so all in all it will come together so that it comes back and they report to me the HOD. Wherever there are problems, we try to iron it out as a*

*team. Actually, we are working together, even if I am the head. It is not just that it is one person, we are sharing ideas.”*

Another factor is that the teachers of the rural schools are also sitting in on the lessons: *“We saw there is a lot of development from the teachers' side as well. You must remember when we transmit the lessons, all the teachers from the other schools sit in and they actually listen to the same lesson. So if there were teachers that were not trained to teach grade 11s and 12s, at the same moment, they listen to a lesson and get trained without us saying it is a training session.”* (PM). They also developed better computer skills as a result of the project: *“Ja, there have been for instance the ICT in our teaching nowadays and, so we are in the position to make our lessons more effective, and to use computer skills, and I am confident to be able to cope in this situation”* (Max, rural school teacher).

There are teachers doing research for further studies, using the privilege of the internet and IWBs to their advantage and further development.

Sam (rural school teacher): *“the teaching benefit that is here I think, is a kind of exposure, like for example, there is a particular computer company, I am invited for a kind of seminar this coming Tuesday. It is things like ICT that helps me to be more interested, and I can see if I can't get more experience in computing with them, as tutoring for my PhD. If I was teaching with the chalkboard, I wouldn't have been interested in something like that”.*

Ralph (rural school principal): *“the teachers now want to study further in their own subjects. She is busy at Wits doing a HED in Mathematics, the science teacher is studying through UNISA, doing an honours degree in Physical Sciences, so they are motivated to learn further.”*

Many of the rural teachers said that their **workload decreased**, because they did not have to prepare for the transmissions and they do not have to redo their lessons every time. *“Now when we use the equipment, you can write on the smart board. You can write your notes, there and then save them and, when you need them; you can always go there and retrieve them”* (Mark, HOD, rural school). The **common tests**, drawn up by the leading school, increased the workload in terms of marking for all the schools, but not in terms of teaching for the rural schools. Teachers and learners have become **ICT literate** and the teachers have **more time**, being able to use the saved lessons and not having to redo all the work on a blackboard.

According to William (rural school principal): *“our teachers are now able to express themselves easily. They are able to follow the **syllabi** without any difficulty.”*

Many teachers comment that they **do not need any supervision** when doing their work; they are self-driven by their own goals. The rural schools follow their own schedules outside the transmission time, affording those teachers opportunities to make choices about how to gain maximum benefit from the transmissions. Some teachers think they need to discuss the topics that will be transmitted, with their learners before the transmissions, while others believe they need to re-teach the topics afterwards, to ensure that all the learners are on par, because some learners may lose the thread of the transmissions.

**Training** is a very important aspect of this ICT project. For the teachers of the leading school, there is weekly training on every Wednesday to keep them updated with the latest, most innovative lessons they can deliver. The leading school also offers training to the rural schools on a quarterly or sometimes monthly basis, on how to use the computer and IWB, as well as the different software for the program that they are using. If new teachers join the rural schools, the project manager will ensure that they receive the necessary training, from the most basic to advanced, so that they are able to use the technology. According to the administrative officer, a lot of teachers were not computer literate, and through continuous training in the project they became computer literate. According to the representative of the MDoE: *“Training is focussed not only on the hardware aspects of the project - how to use the boards, computers, software etc. - but also on the softer aspects of the interactive whiteboard as a tool/support for the teacher to engage effectively with children and to deliver the curriculum.”*

The **principals** in the project support and drive the concept, and motivate the staff to play an active part in it. Without buy-in from the principal, the project will not succeed.

Wikus (leading school principal): *“if the headmaster is not positive, it is very serious. You will struggle to get the project going”.*

William (rural school principal): *“I might say the principal should be brave enough to allow the school to have such a project”* and, according to the AO: *“Definitely, a*

*principal that will get on board; if the principal is positive about the project, it is the first big step that they have to take”.*

The rural school principals are still in charge of their own schools:

PM: *“They have their own school management system. The principal is telling them how to manage their classes, so we don't want to come in with our project and change everything in their school.”*

The principals are working together with the **SGBs**:

Ronald (rural SGB member): *“The project that we did in this school, we try to organise with the principal all the time, because we work with the principal hand in hand. Any decision that we take, we come together as a team and talk about it seriously before we come to a conclusion.”*

According to the leading school principal, their governing body did a lot. They have a vision for change and realise the magnitude of the problem in South Africa and that they need to help the people around them. They are willing to put in money from their side (according the project manager, they are always giving the green light for their school to be part of the upliftment of the community around them), and they spend around 1 billion rand a year on the project, mainly paying for extra posts. The governing bodies of the rural schools are also very positive about the project.

According to Billy, a rural school principal, their governing body is responsible for the security of the technology, the insurance and asset management. According to Ralph, another rural school principal, their SGB has to see that the project itself runs without any hiccups and he reports to them if there is any need for repairs. According to Tim, a project coordinator, the whole governing body bought into the concept. They function as a team, and once the school is in favour of any particular project, the SGB and community buy into it, the project is launched and every step is monitored, debated, and approved or disapproved.

According to the principals, the project supports their **mission and vision**, and is making life easier, because they want to provide quality education and the project assists them with that. According to the leading school principal, their vision and mission is to lead people to God and to help the people in their surroundings to become valuable and responsible citizens. A rural school principal says their motto is “hard work brings success”, and the main purpose of the ICT project is aligned with

their school's mission, which is to cultivate prosperity and the love for learning and to develop learners who are competent in the 21<sup>st</sup> century. Another says that their vision is about effective teaching and learning and the project ensures that learners are learning according to the expected standards and with ease.

The principals are very positive about the **investment** of the sponsors in the project and their attitude towards the schools and the project:

Billy (rural school principal): *"I would say I've seen the positive part of it was from the private sectors, and you would understand that this project was started by Xstrata, which is getting so much of the social responsibility. These people, definitely, they are good Samaritans; their hearts are completely into investment, in human investment, which it is something positive, when you look into where we are now as a school in the rural area, we should be part of this. They contributed so much, and this is something very positive and the way that they relate to us as a school, and not only for the e-learning, in many other projects, wow! That is so positive."*

Ralph (rural school principal) says: *"May I start with the sponsors, who are dear to my heart. Their positive attitude to a previously disadvantaged school has created an atmosphere conducive for even the most rural school. You are as important, you may achieve the best through this project."*

The principals are responsible for the **timetables** of their schools, and it was necessary to change the timetables of all the schools to fit in the transmissions:

PM: *"Luckily, our timetable in our schools worked out that we can use Mondays Tuesdays and Thursdays, the first hour, we can manage to give our full time on transmitting these lessons. From the other schools' sides, there were no problems; they just take their own timetables and make sure that they synchronise with ours, but no major disruptions, no."*

Mark (rural school principal): *"The first thing that I think important that actually we put aside enough time for the lessons that are transmitted from the LS so that there is no clash of periods. So in most cases, those lessons are in the morning, first periods. We do have programs for those lessons that are transmitted, so we know very well what is going on this day and that, today, there are no clashes; teachers are ready to allow those teachers from the LS to transmit lessons to our school, so I think that is working well."*

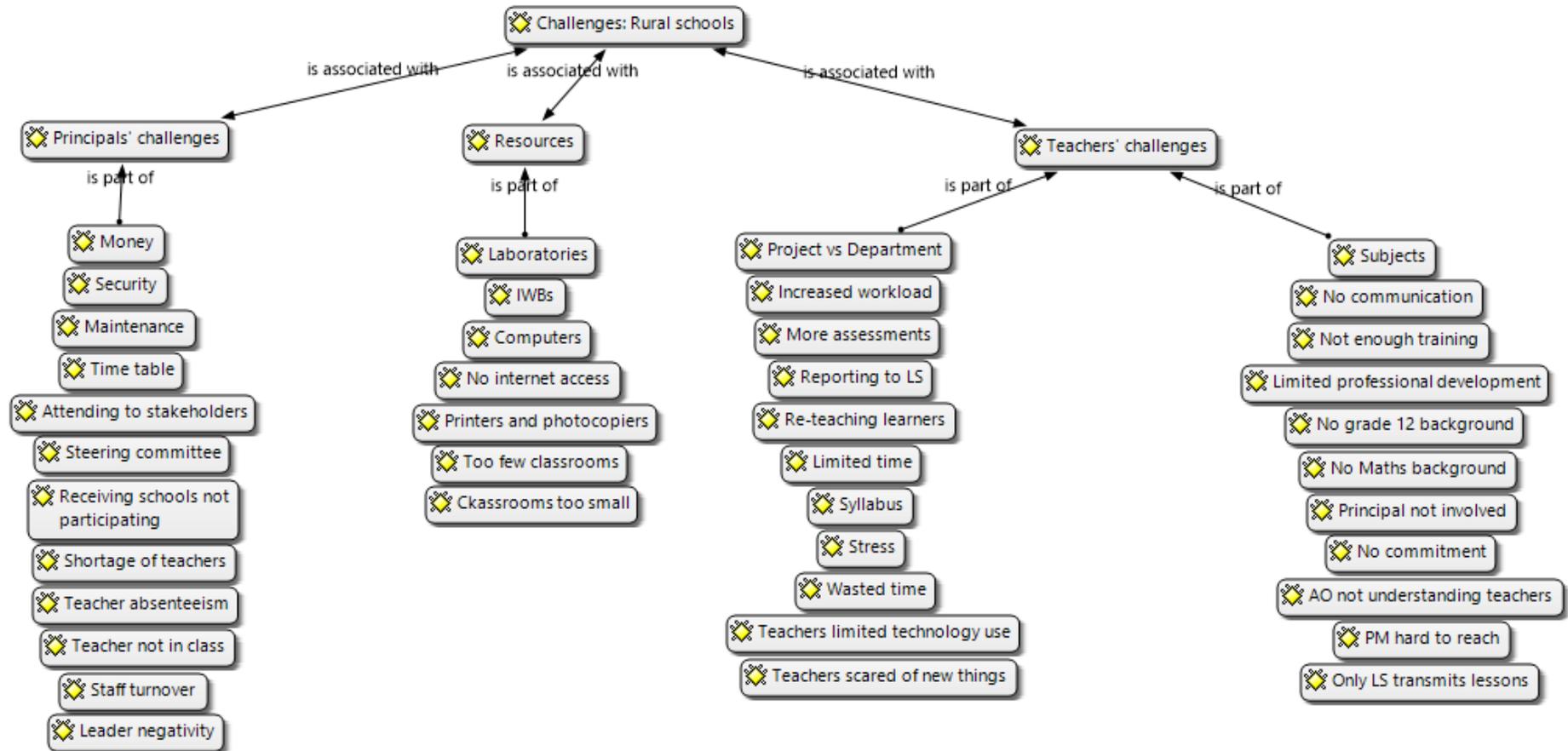
Only one school did not change their timetable to accommodate the grade 11 transmissions.

#### ***4.5.2 The key management challenges in the project***

The main research question of this study was: What are the key managerial challenges faced in implementing an ICT network that involves a network of schools?

In figure 4.4, the management challenges in the rural schools are depicted. All the challenges are eventually part of the principal's challenges, as everything about teacher's problems will be reported to him.

Figure 4.4: The management challenges in the rural schools



The rural schools have different challenges in terms of **resources**. This emerged as a concern in 25 quotes. Some of the rural schools do not have Science **laboratories**. Here the project offered a solution, because experiments can be watched on the IWBs. The rural schools need more **IWBs**. One of the rural schools has only two IWBs, another three, and another four. They are budgeting to buy more, but their school fees are very low. Everybody wants to use the new technology and to expand the project to other subjects, but an IWB system is costing about R25000 to set up. They also need more **computers**, and many of the learners do not have enough exposure to the **internet**. They are having problems with printing and photocopying of the notes that they receive from the leading school. Some of the schools have only one **printer/photocopier**, and it is not always operational. One of the schools has **too few classrooms**. When the transmissions are taking place, the grade 12's have to be split into more than one class. Another school needs **bigger classrooms** to accommodate the larger number of learners taking Mathematics and Science.

In figure 4.4, the rural school teachers' challenges are also shown. There is a difference between the programmes of the **project and the Department**, and it was raised as a concern through 23 quotes, although the order and pace of work that is stipulated by the Department curriculum should be followed. Sometimes they begin with a particular topic in the district in Mathematics or Physical Science and, in the ICT project; they started with another topic, which creates a problem in the sense that two different assessments must then be conducted, when one common assessment might have satisfied the requirements of all concerned. Sometimes teachers have to give extra classes to keep on par with the demands of both the project and their subject.

Ralph (a rural school principal) says: *“The teacher will have to satisfy the needs of the district and, at the same time, looking into satisfy the project itself, so tests that are for the project, they are written by the learners and the tests for the district, they are also satisfied as far as possible.”*

Gerry (rural school teacher) says: *“Yes, there was some disruptions in the sense that like when talking about managing my work, the Department says you were supposed to complete this particular stuff by that time, and with the order in which you have to*

*do it, but the e-learning they can come with another order, but at the end of the day we end up doing the work.”*

Delia (rural school HOD) says: *“What I would like to add is, if it can be possible for the organisers to look at the programme and make provision for if the programme can be the same as the work schedule, so that those learners can be on par with the work schedule of the Department that will be better.”*

Some teachers in the rural schools reported a challenge with **increased workload**, mainly as a result of **more common assessments** written by all schools.

PM: *“And from the rural schools, definitely have more workload as well, because we want reports back, feedback, we write more tests and exams, so they must mark more tests and they must give more feedback, so there is more workload on them as well.”*

Robert: *“I can say yes, because there are different evaluations on the timetable. So I can say that sometimes the Department of Education want this week the test must be written, so we need to mark the test. Maybe the same week also, there are waiting a test for this e-learning, so the marking. I have many classes, so we have to mark the test for e-learning and we have to mark the test for the Department of Education, so I think basically the workload is more on the marking but not on the teaching.”*

The common assessments must be marked and then the marks must be **reported** to the administrative officer of the leading school.

Mandy: *Internally the HOD, I do that, externally you can say, the leading school, the administrative officer, as I am saying, we have to send the marks in, after we have written a test, so but even if we go to a meeting, then we discuss, but to make sure that we send marks, she is having the marks of learners with her.”*

Some teachers feel that they have to **re-teach** the learners after the transmission to ensure that everybody is on par. This may result in **limited time** to get through the **syllabus**, especially for the grade 12s.

Adri (rural school teacher): *“This lady that is teaching the lesson has no idea who is listening and who is not listening, who is paying attention and who is not paying attention, and then after that hour, that double lesson of e-learning, I need to re-teach that work, because they were not listening they were not paying attention, and*

*it is not always their problem; sometimes they lose the teacher in the first 10 minutes, while in my class, they can put up a hand and say I didn't follow, please repeat."*

Tim (project coordinator, rural school): *"it involves time; there is a lot of pressure to get through the syllabus"*.

One of the teachers is even of the opinion that the project should not be implemented in grade 12, as a result of the fact that they have to finish the syllabus in August. She suggests that the project should rather be incorporated in grades 10 and 11, because she gets stressed if there is e-learning for grade 12s:

Adri (rural school teacher): *"I get **stressed** when I hear there is e-learning, because I have to redo that lesson; I really get so stressed."*

Some interviewees also mention the additional challenge caused by a change in the **syllabus** as a result of the introduction of CAPS.

Annie (leading school teacher): *"The changes that occur every year are those in the syllabus, as with the new CAPS syllabus that is implemented now. Next year's matrics are going to start with that, so I have to redo all my work, while in the past, you just changed it a bit every year."*

AO: *"maybe there will be a bit of changes next year as the CAPS is coming. That will definitely bring on a few changes, that we maybe will have a challenge with"*.

**Time** is normally **wasted** when there are electricity interruptions, because teachers have not done the necessary preparation to teach a different lesson with chalk.

Adri (rural school teacher): *"and there are electricity interruptions every second week almost and then you didn't prepare a lesson, and you are running around, and then the bell rings and you have wasted all that time, so that was a challenge,"*

Some of the teachers are **not using the technology or are scared to use** it, because they are **scared of new things**.

William (rural school principal): *"in times educators and learners are unable to cope with technology, then it means that the educators must be willing to learn and they must learn every day, so if they don't have interest in technology, then it is a problem, because you might have the apparatus but no one is able to use it; that is a problem."*

Jack (rural school SGB): *“Yah, as I've mentioned in the new things and then people they are scared of it”*

Many teachers feel that the ICT project should be extended to **subjects** other than just Mathematics and Science, so that other learners in the school do not feel left out: Robert (rural school teacher): *“I think they must focus not only on Maths and Science. They must also include subjects like Life Sciences, Accounting, Business Economics, because other learners that don't belong to Science and belong in Commerce, they feel belittled if they don't attend such a programme that is attended by the Science students”*.

Delia (rural school HOD): *“What we need is if these smart boards can be installed for as many subjects in the school as possible, like for all the subjects in grade 12. That will be an achievement because the school can be able to achieve in all the learning areas.”*

**Communication** is also sometimes problematic, in more than one way. Teachers were, specifically in the beginning of the project, too shy to ask if they did not know what to do. A bigger challenge was that the Maths Literacy broadcast at one of the schools just halted for three months, without any communication from the leading school as to why it did not happen. Then, just as suddenly, it restarted, also without any communication. Here a clear line of communication from the project manager to resolve this troublesome and confusing situation did not exist.

Wilma (leading school HOD): *“I think it is sometimes just communication problems and problems when a teacher is too shy to ask another teacher,”*

Eddy (rural school principal): *“So there is no real communication in it, saying ‘You know what, because of ABC, it's doing this, or why didn't you join in?’ Like I said, just Boom! it was gone and Boom! it came back, no communication ‘Okay, now we are back online’ or why - nothing - but it was the Maths literacy part”*.

Only two teachers expressed **dissatisfaction with the training programme**. This may mean that, at certain times, the project is operating with insufficient team skills, as teachers are assigned to the project as a result of the subjects they are teaching and not as a result of their skills. An untrained team member can slow down the progress of the team.

Adam (rural school teacher): *“Generally, most of the things, I had to learn them on the job. I just received basic training in how to use the board, but programs that are useful in the learning of Science and computers I had to learn on the job.”*

Rudi (rural school teacher): *“I can say it was inadequate. It was not enough because it was just 30 minute sessions, so most of the things I had to learn in operation.”*

One principal reckoned that there was **limited professional development** as a result of the rural schools not being able to transmit lessons as well:

Eddy (rural school principal): *“Limited, I would say. Like I said, it would have been ideal had they trained the teacher also to present a lesson at some point, on a rotation basis, or on a voluntary basis, but giving every teacher an opportunity.”*

Eddy: *“Teachers, like I said, they are a bit sceptical sometimes. They think it is holding them back and, if not given the opportunity, maybe you have a complex, you know, ‘I am not good enough’, and also, although I didn’t have the problem, but it can create a lazy teacher; a teacher can become lazy and say, leave it at that stage.”*

Two teachers and one principal are of the opinion that **the teachers of the rural schools should also get a chance to transmit lessons**, and not only the HODs and teachers of the leading school.

Max (rural school teacher): *“I think it will be more helpful if other educators from the other schools that is in the project, they would be given the chance to transmit this topic, so that we have the contribution by other teachers”.*

Adam (rural school teacher): *“I am not saying that what we are getting is bad. I am saying no one is 100% and that there are teachers that are strong in certain areas and if they could also be used, the learners would benefit more”.*

Some teachers at the rural schools **do not have the necessary qualifications to teach grade 12s or the subjects** being transmitted, but they get trained in the project:

PM: *“So if there were teachers that were not trained to teach grade 11s and 12s, at the same moment they listen to a lesson and get trained without us saying it is a training session,”*

Lindie (leading school HOD): *“Most of them are not really grade 12 teachers. Some of them, they give Maths and they do not really have the background for Maths.”*

Only one teacher mentioned that her **principal is not involved** in the project and that he does not know what is going on in the project.

Adri (rural school teacher): *“No, I am reporting to the admin officer, faxing her marks, and she is working at the LS. The principal is not really involved in this project. If you have a problem, I am sure the principal's door is open. He will any time listen to your problem, but even if you go with your problem to him, he does not really know what is going on.”*

In general, the teachers, project manager and administrative officer from the leading school are very positive about the teachers and HODs of the rural schools, but one comment was made about a **lack of personal commitment** on the side of some of the rural teachers:

PM: *“And then the teacher commitment of some of the schools, they participate fully, but the personal commitment, that extra mile, you find sometimes that there is not that extra mile that they want to walk. Sometimes it is easy for them to give an excuse why they didn't log in, maybe ‘I forget’ or something like that, and at the end, we talk to the principal, but it is a personal thing.”*

One teacher from the rural schools also mentioned that the **administrative officer** is not a teacher and, as a result, **does not understand the teacher's challenges**, requesting the marks at inconvenient times. The **project manager** is very busy and often out of the country and is therefore sometimes **hard to reach**, and nobody is standing in for him:

Adri (rural school teacher): *“Role players, like maybe this lady at the leading school who is collecting the marks, maybe she is not involved in teaching to understand really what is going on in the class. She is only doing administration, and you need to give her the marks whenever she wants it, and sometimes she doesn't understand that we as teachers are really busy.”*

Adri: *“The coordinator of this network is sometimes very hard to reach, because he is often out of the country, often out of town whenever you experience a slight problem.”*

The rural school principals' challenges are also shown in figure 4.3. The principals' main headache is lack of **money**, primarily for things like **security** and **maintenance**. The MDoE does not provide money for the project anymore, except

for a paper budget, and most of the financing comes from sponsors. The sponsorship money is mostly used for new IWBs and upgrades. It also provides paper, although it is not enough. In the rural schools, the school fees are very low, and school budgets, controlled by the principal and SGB, are used for buying more IWBs, security, insurance, upgrades and paper, but regular upgrades are needed, and the rural schools do not have sufficient money for this. The different schools face problems in managing ever-growing networks of computers with limited resources. Limited budgets need to be balanced against the need for secure, current technology. A systematic plan to refresh out-dated technology forms part of the strategy of the leading school.

MDoE: *“Maintenance of the system is very difficult without a budget from the MDoE.”*

PM: *“The first thing is the maintenance of our hardware, that’s our need for now. We have the people in place but, as I said, the IT is getting older after three, four years especially the network. A computer, after four years, it’s old and the programs are getting bigger and bigger and so the maintenance of this hardware, to upgrade it after three, four years”.*

Billy (rural school principal): *“Remember, without governance, you can’t win. Security must be available” and “so the SGB is responsible directly for that and ensuring that. Also, together with asset management, they are ensuring that the public gets educated to see the need for them to own up for the school and to try and safeguard the school.”*

Most of the rural schools encountered challenges with their **timetables** in order to accommodate the transmissions, but they succeeded in doing it. Only one school is not receiving the grade 11 transmissions.

PM: *“It was not major, but the timetable to synchronise that, especially this year, when we started with the grade 11s. On a Monday we do grade 11s, so some of the schools, they feel that they don’t want to participate. It is actually only one school on the Mondays, because they don’t want to change the timetable that much, but the timetable was a little bit of a problem,”*

William (rural school principal): *“One of the problems is that our timetable does not correspond with the times and dates of the programme of the project. For example, if they start at 8, we start at 7:30 and, when they choose their timetable, it is not easily*

*followed because we must be in line with the timetable that is utilised by other schools”.*

Billy (rural school principal): *“The challenges were with regard to the timetable, because you will understand that we are clustered together with the leading school and other schools where we got to make sure that we connect together at the same time. So getting the timetable to be adjusted to suit that in this school - we have a lot of learners, more than 16 or 17 learning areas in a grade - it is complicated.”*

The principals may have other commitments when people come to visit for the programme, and **cannot attend to the stakeholders**, or have to take care of Departmental commitments first, while commitments of the programme have to wait.

Billy (rural school principal): *“The challenge becomes that, within the decision-making, if it is properly monitored, the authorisation of some issues, wherein the leader may not be able to know if any visitor will be coming. People [who] are coming for the project, at times, communicate it directly to the teachers or to the other members, like the project coordinator and they want to see me and I may be otherwise committed when they come. It becomes a problem. Or else they phone me and I overlook the matter and, when they come, I might be, because of some arrangements, unable to see them. These are some of the challenges and, because of the complexity of the programme, now, many times, we have to attend to stakeholders”.*

William (rural school principal): *“I might be visited by departmental officials from the head office, unannounced. Then of course I should attend that and forget about the project, so that creates a problem, whereas maybe we are supposed to make some submissions on that day and I am unable to do that, or maybe to attend some meeting, and I am unable to attend because I've got my own schedule or other meetings that [were] just scheduled by my seniors.”*

The representative of the MDoE mentioned a **principal’s forum and steering committee** as important tools to take care of management challenges in the project. He also reported a potential challenge that may arise as a result of all the initiative coming from the leading school, thus allowing for the possibility that the **rural schools** will just sit back, stay on the receiving end and **not participate**:

*“This was one of my concerns from the beginning – one-way traffic and the receiving schools’ teachers sitting back and not participating. I requested the leading school leader teachers and the project team to ensure that a programme of sharing the responsibility and accountability be developed to ensure not only the sustainability of the project, but also to ensure that knowledge & skills were transferred and mastered.”*

Rural principals are having a few challenges concerning their teachers. In some schools, there is a **shortage of teachers**, while others are experiencing problems with **teacher absenteeism** and **staff turnover** as a result of teachers leaving. New teachers have to be retrained, and that training maybe perceived as inadequate.

Wikus (leading school principal): *“The problems were when people came late; you have to start with the transmission lessons, people are not in the class. It might be the teacher; it might be the pupils because of a bus coming late,”*

William (rural school principal): *“and another challenge is that when the teacher is sick or is not at school, then there is a problem because [the learners] should be with an educator when they are being taught in this project.”*

Lindie (leading school HOD): *“from our side no changes, no problems. At the other schools there are a few problems. The teacher of the one school was sick. Now it helps a lot when the children are in the class and there is a responsible teacher in the class to keep them quiet, but they cannot ask a substitute anything, so in some of the schools there are constant changes with the teachers. This year, it is the ‘this’ teacher, and next year ‘this’ teacher is gone and another teacher is in there, so that is a little bit of a problem”.*

**Leader negativity** is mentioned as a challenge by one principal, although it did not seem to be a challenge contributing to the overall management of the project:

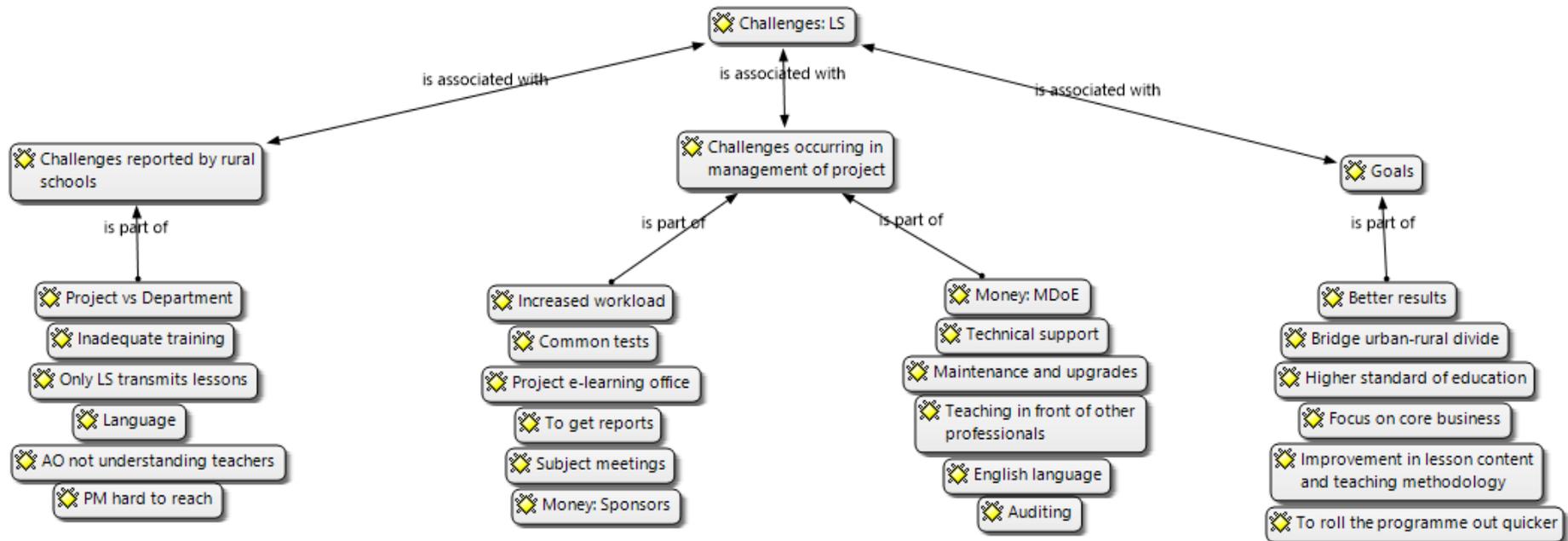
Wikus: *“The big problem is always managing yourself if the leader is not positive; you will find that he tries to pull the project down”.*

In figure 4.5, the challenges of the leading school are shown. They are different to those of the rural schools. Some of the challenges can be seen as project goals that they set for themselves, while others are difficulties reported by the rural schools to the leading school. The fact that the **programmes of the project and the department** do not always correspond to one another is seen as a challenge by

more than one rural school interviewee, while the leading school believes that they just help the rural schools to follow the pacesetter of the Department. Two rural school teachers mentioned that they consider the **training** of the leading school to be **inadequate**. Although three interviewees reported that they also would like their **schools to transmit lessons**, the leading school believes that their teachers are much more experienced and should handle the transmissions. This opinion is also reiterated by interviewees of most of the rural schools. The use of **English as the language** of communication is seen as a challenge by some teachers. One rural school teacher reported that the **administrative officer does not understand the teachers' difficulties**, and that the **project manager is sometimes hard to reach**, mainly because he is frequently out of the country.

In figure 4.5 the goals of the project are depicted. They can also be regarded as challenges to overcome in the network. The goals of the project are clear for everybody involved. The main goal is to obtain **better results**, mentioned in 35 quotes, and the schools are striving for a 100% pass rate and the allocation of bursaries to top learners for further study. The **bridging of the urban-rural divide** is being achieved in the sense that teachers and learners of rural schools are becoming more ICT literate, they can now use the IWBs and computers in their everyday lives, use the software to their advantage and are able to take advantage of internet access for the purposes of research and further study. This leads to a **higher standard in the quality of education**, mainly in the “difficult” subjects Mathematics and Science, but also in other subjects, as schools are expanding the use of IWBs to other subjects as well. In this project, the **focus** is on teaching and learning, which is the **core business of education**. Lessons of a high quality are prepared for transmissions, and teachers are proud of their efforts. **Lesson content and methodology is adjusted and improved** yearly. One of the main goals is to **roll out this project to other schools and provinces**. A similar project was started in two other Mpumalanga towns.

Figure 4.5 Management challenges in the LS



All the interviewees in the leading school report an **increased workload** (mentioned by 25 quotes), as a result of the preparations for the transmissions, holiday schools, common tests and moderating of the marking:

PM: *“So it is not that there is no input from the rural schools, but the workload on our teachers is much more because they must present the lessons, they must write the notes per week, and they must put it on the server. That is not a small workload”.*

Wikus (leading school principal): *“On the other hand you will find that the meetings take a lot of time, the September holidays is an add-on and, on the technology's side, you will find they must set up all the technology. That's a lot of work extra.”*

Wilma (leading school HOD): *“Yes, yes. It is lots of hours to work out the whiteboard lessons, the year, it is lots of work. It is hours and hours of work that you have to do, and then every year you must better your lessons, make it better, put a joke in, maybe a picture, so the workload is really big”.*

It was a challenge for the administrative officer to **get the marks reports** of the **common tests** from the rural schools, but they alleviated the problem by appointing someone from their own school to fetch the results. The **meetings** are used to discuss and iron out challenges. The **common tests** are set by the leading school teachers and HODs. This is a challenge because it is contributing to the increased workload of all teachers and it is necessary to set a proper standard for all schools.

Lindie (leading school HOD): *“because normally we want the results before the meeting and we have a meeting this coming Thursday, and we want the **results** before that, and in the first year it was not always possible to get it before the meeting, and then they come to the meeting with the results, and then we cannot really combine and discuss it,”*

PM: *“and then, once a term, we have a meeting where we just discuss the next term's work that we are going to do and in the same **meeting** we divide up in clusters, the **Maths, Maths Literacy and a Science clusters** and then they do topic discussions. So the Mathematics sits around and discuss what is your problem that you have and then in that meeting they sit and discuss with each other around that topic what is difficult and what they don't understand and when they transmit that lesson they just make sure that they focus on that problems”.*

It is a challenge to find enough **sponsor money** to sustain the project, especially since the MDoE does not contribute financially to the project anymore. The project manager is in charge of the budget for the project. The leading school takes care of the **technical support** and most of the **maintenance** in the project. This is taking a lot of time and money, but, according to the interviewees, this is taken care of very well, although the leading school mentions that there may be a problem with service providers:

Wikus (leading school principal): *“I think the biggest problem might be the service providers. If you've got the wrong service providers, they don't show up within 24 hours for a computer or for a problem on the transmission line. You can have problems with that,”*

PM: *“The first thing is the maintenance of our hardware, that's our need for now. We have the people in place, but as I said, the IT is getting older after three, four years, especially the network. A computer, after four years it's old, and the programs are getting bigger and bigger, and so the maintenance of this hardware, to upgrade it after three, four years, and then, the replacement if there is for example stolen computers, the insurance is in place, but we need the money for the upgrades.”*

One of the teachers mentioned that she was shy **to teach in front of other professionals**, and also to teach in **English**.

Annie (leading school teacher): *“To speak English, because the way in which you have to explain is not the same than the English in which you explain to our children, and to teach in front of grownups, was a big challenge for me, because in front of kids you can act like a clown, but now suddenly, you have to be professional. It was a big story for me”.*

The principal of the leading school mentioned that they are taking care of internal and external **auditing** of the project.

Wikus (leading school principal): *“It is always good to do some internal auditing, as well as external auditing. For the external auditing, we had Tukkies University, for which we are very grateful. They came here some years ago, they did the external audit, they found there were things not going right in this project and it was good for us to see which is the part where we can do better, but they also told us that it is a good project, that this is a way to go forward, which is for us [was] a meaningful*

external audit. And the internal audit is very important as well, so you need people to go in each and every school, to go and speak to the teachers, to check out what they are busy doing, if they are doing the things that were decided on the meetings, that they do that”.

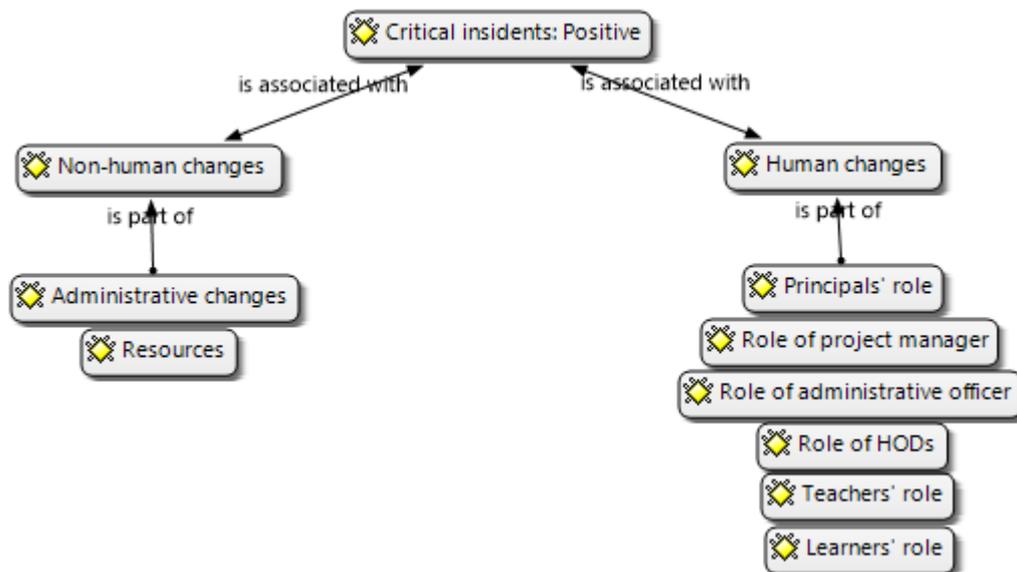
#### 4.6 Critical incidents that occurred in the project

The third sub question was:

What critical incidents occurred during the life span of the project that had an effect on the management of the project?

Critical incidents can be divided into positive events and challenges. The positive incidents in this project are displayed in figure 4.6.

**Figure 4.6 Positive critical incidents in the project**



The **e-learning project office** can be considered as a positive administrative change. Before the e-learning project office was established, all the planning, administration and management necessary for this network had to be done by the project manager and it was difficult for him alone to cope with the ever increasing demands of a project of this scale and scope. Administrative tasks are now handled by the administrative officer, while technicians and an IT administrator take care of the technical support and maintenance. All the schools are very positive about the technical support and maintenance handled by the leading school. The scheduled quarterly **meetings** are another positive administrative change. In these meetings,

the yearly project plan and infrastructure of the project are discussed. The teachers meet in subject groups and plan things like the common assessments and the learning exchange programme between the different schools.

**Resources** like computers and IWBs are given to the disadvantaged schools. The technical support, maintenance and upgrades of these resources are mainly taken care of by the leading school. Some of the schools are very positive about the technical support and maintenance handled by the leading school. The disadvantaged schools also now have internet access, something that was not in place before the project started. Some of the schools are also budgeting for more IWBs to use in different phases, and one school even had IWBs installed for grades 1 to 6.

The **principals** play a major role in the acceptance and roll-out of the project in their schools. If their attitude is not positive, a project like this cannot run. They work together with the SGB on the budget for this project, mainly for security and insurance and some schools are investing in more IWBs. The principals have to incorporate the use of new ICTs in the mission and vision of their schools. They are in charge of the timetable and have to ensure that the transmissions from 8:00 to 9:00 on Mondays, Tuesdays and Thursdays fit into their school's timetable. The teachers and HODs of the rural schools still report on the developments in the e-learning project to their principals.

The **project manager** plays the most important role in this project. He initiated the project and is visiting national and international expos on the development of e-learning and the IWBs to stay abreast with the newest developments. All the final reports on the project still come to him, although he does not have all the responsibility anymore as he did in the beginning of the project. He reports only to his principal and gives feedback to their school's SGB. He is in charge of finding sponsors and allocating resources to schools. He handles the marketing of the project. As a result of this project and his involvement in it, his school has already received numerous awards from the wider education community.

The **administrative officer** was appointed in 2011 in the e-learning office to take care of all administrative matters. She is mainly in charge of getting the marks of all the common tests from all the teachers involved, and she discusses the improvement, or lack of it, in the quarterly meetings. She keeps a record of the pass rate statistics in every subject. She is also in charge of the yearly plan. According to the project manager:

*“The administrative officer plays a huge role in this. You can take one person and run this whole network, but there will be a lot of things that won't get in place.*

*The administrative officer is a key point in this, in the success of this whole project. She must, on a daily basis, talk to the people, make sure that the reports are back in, [ask] ‘Are there problems’, make sure it gets to the IT specialist, but then IT is just as important to get your whole structure in place, make sure it is sustainable. It is definitely the AO in this whole project”.*

The **HODs** of the leading school are in charge of the transmissions and the subject group meetings. These teachers are responsible for the information exchange in the network and they are ensuring that a high standard of education is the norm. They use different teaching styles and methods during the transmissions and work to improve the standard of the lesson content and methodology every year. They are very proud of the standard of the transmissions. They save the weekly transmissions on the server to ensure that anyone who missed a transmission can have access to it, or use it as revision. They also ensure that peer teaching and coaching is happening in the subject groups. The **HODs** of the disadvantaged schools sometimes have grade 12 Science and Mathematics classes themselves, and then they sit in on the transmissions. The Science and Mathematics teachers of their respective schools report to them.

Some of the **teachers** in the disadvantaged schools have reported a decrease in workload, because they are not responsible for the preparation of the transmissions, and they receive all the notes and common tests from the leading school. They report that they can take care of their classes without supervision, but they have to report to their HODs and principals. They receive training in using the IWBs and the software associated with them and report a higher level of ICT literacy. They also report professional development, because they sit in during the transmissions, and

learn different methods to use in teaching their subjects. The rural school teachers ensure that the notes are copied for the learners and that they are listening during the transmissions and participate in them. They are in charge of the microphone, which they give to learners if they want to ask a question or write something on the IWB. The teachers also have to determine if they have to re-teach a topic or any part of it after the transmission. They are in charge of their own results.

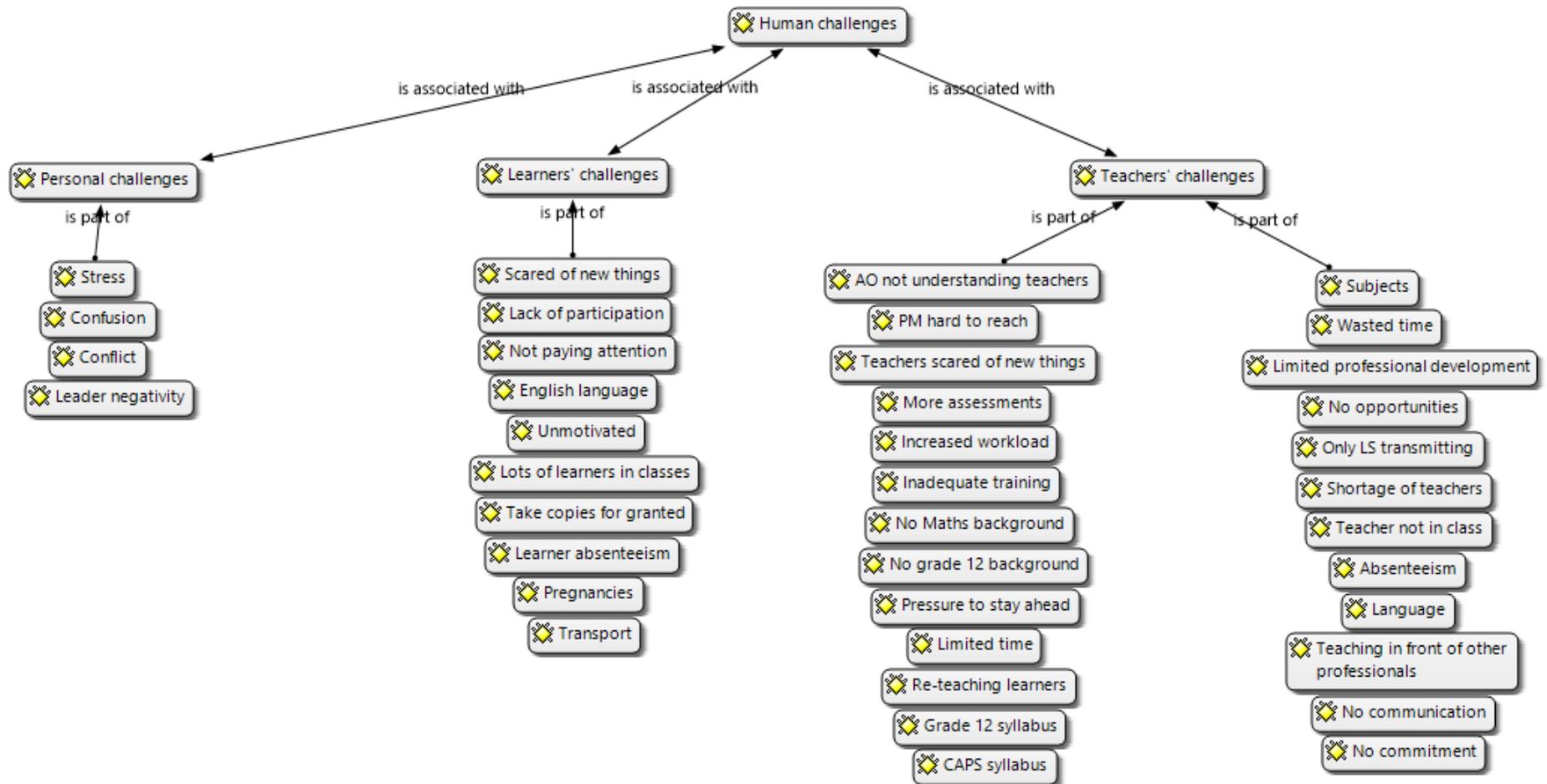
Everybody reports that the teachers are more motivated (36 quotes). They are more motivated because they can now keep the attention of the learners in the class. One rural school principal reports that he had more IWBs installed in classrooms for the lower grades as a result of the motivation showed by the teachers that used the IWBs for the transmissions. He also reports that the teachers are motivated to study further; one of his teachers is doing a HED in Mathematics, and his Science teacher is doing an Honours degree through UNISA. Through an Eskom sponsorship, each teacher's office now has a computer on which they can set tests and memoranda, enter their marks, and have email and internet access.

Everybody (except one teacher) reports that the **learners** are more motivated (32 quotes). For them, this project presents something new. They love technology, and when they are in the IWB classes, their eyes open up and they are interested in the lesson (according to Eddy, rural school principal). "The learners can visualise abstract concepts better, they see it like it is on television. It is not like reading a book, they see everything in nice and sharp colours, and they are really enjoying it." They are now exposed to the internet and a multitude of knowledge sources, and it is opening a new world for them. This has a positive influence on the community, because the learners carry their new-found knowledge and skills back to their homes, so the parents feel that the learners have a chance to get out of the vicious circle of poverty. The teachers report that there is a difference in the behaviour of the learners in the classrooms. They are not absent as often anymore, and more of them want to take Mathematics and Science. The learners in the different schools are all receiving the same quality of education now; they listen to the same teacher and receive the same notes, and they are motivated, because it is more interactive to talk to learners from other schools, across races and between different schools and areas. Some learners are now obtaining bursaries for further studies and a lot of

them are going to university, and they pass, while it was not possible in the past. The learners find it difficult now to attend ordinary classes where there is no interaction.

In figures 4.7 and 4.8, the negative critical incidents of the project are shown, divided into human and non-human challenges. These critical incidents mostly affected the rural schools.

Figure 4.7: Negative critical incidents in the project: Human challenges



The teachers report a lot of challenges, but none of them are very serious or reported by many different teachers. One teacher reported that the **administrative officer does not understand the challenges of teachers**. She is not a teacher and wants the marks whenever it suits her. The administrative officer now sends a worker of the leading school to collect the marks when she wants them, so that a lack of transport cannot be an excuse anymore if the marks are not sent to the leading school. In this way, the statistics of the marks are available at the quarterly meetings. Another teacher reported that the **project manager is sometimes hard to reach**. This influences the teachers because the project is his brainchild and there is no-one to take his place.

Some of the **teachers were scared in the beginning to use the new technology**, but as a result of the training, they are now able to use the technology in their classes. Only two rural school teachers reported **inadequate training**. Some rural teachers **do not have a grade 12 background or a Maths background**, but the teachers are also sitting in on the transmissions and they are listening to the same lessons as the learners and receive training in this way.

As a result of the **common assessments**, some of them are reporting an **increased workload**. This is the most common reported challenge for the leading school teachers, as a result of the preparation for the transmissions and the setting of the common tests. Some teachers teach the topics of the transmissions beforehand, so that the transmission is like a revision lesson. They feel **pressure to stay ahead**. Others are **re-teaching the topic** afterwards. Both groups are feeling that they have increasingly **limited time** to get through the **grade 12 syllabus**. The new **CAPS syllabus** will also create challenges, because teachers have to prepare work in a different way. Many teachers feel that the transmissions should be done in more **subjects**. When they have no transmissions as a result of a power shortage, teachers are reporting **wasted time**, because they did not prepare another lesson for that time or did not have chalk available.

One of the principals reports **limited professional development and no opportunities**, because the **rural teachers do not have the chance to transmit lessons**. He is of the opinion that the lessons should be presented by everybody on a rotation basis:

Eddy (rural school principal): *“Teachers, like I said, they are a bit sceptical sometimes. They think it is holding them back, and, if not given the opportunity, maybe you have a complex, you know, ‘I am not good enough’.”*

The leading school is of the opinion that their teachers are more experienced than the rural school teachers and, as a result, they should transmit the lessons. Most of the rural teachers feel the same. One rural school teacher is transmitting Mathematics Literacy lessons.

One of the schools reported a **shortage of teachers**. **Teachers are sometimes absent or late** as a result of transport difficulties in rural areas and staff turnover in rural schools is problematic, mainly due to the resultant need for continuous updating of training. Some teachers find it intimidating to **teach in front of other professionals** and in **another language** than the one to which they are accustomed. The project manager mentioned that some **teachers are not fully committed**, that they do not want to walk the extra mile, but the staff of the rural schools was very positive in the interviews.

The representative of the MDoE noted that communication between schools may be problematic. A teacher of the leading school mentions that other teachers may be too shy to ask questions and that it results in **a lack of communication**. One of the principals raised the issue that their Mathematics Literacy transmissions halted for three months without any communication from the leading school and thereafter simply re-started, again with no explanation. Teachers have the opportunity to discuss any problems in the quarterly meetings, held at different schools on a rotation basis.

Teachers mention certain challenges with learners, like being **scared of new things** and **lack of participation** because, in the beginning, they were intimidated by the cameras, and it is not the same as having a teacher in front of them. Two teachers said that **learners do not always pay attention** in the transmissions. Being **taught in English** was also a challenge for learners in the beginning. Only two teachers reported that **learners are not motivated** and, according to one, the problem arises as a result of too few computers, which means that the learners cannot work on the computers themselves. In some schools, there are also **too many learners in the**

**IWB classes.** One teacher reports that learners are **taking the copies made for them for granted**, and lose them or forget them at home.

Although **learner absenteeism** is always a challenge, more than one teacher reports that learners are present more regularly since the transmissions started. **Transport arriving late** is a huge problem for some of the rural schools. One of the schools awaits busses from six different directions every morning. One teacher also makes the point that learners are out of school due to **pregnancies** and, when they return, the teachers have to get them through grade 12. The saved transmissions are of huge help in these instances. According to one of the rural principals:

Ben: *“Our school's greatest need is to get the kids more involved on a more regular basis at the moment. The intervals between exposures are a bit much and the amount of learners that we've got here is too big to involve them.”*

I asked all the interviewees if the project and, specifically, the reporting process caused any stress, conflict or confusion for the staff concerned.

Most interviewees mentioned **no conflict, stress or confusion**. The main situation causing conflict or stress was the difference between the programmes of the Department and the project. One of the rural principals said:

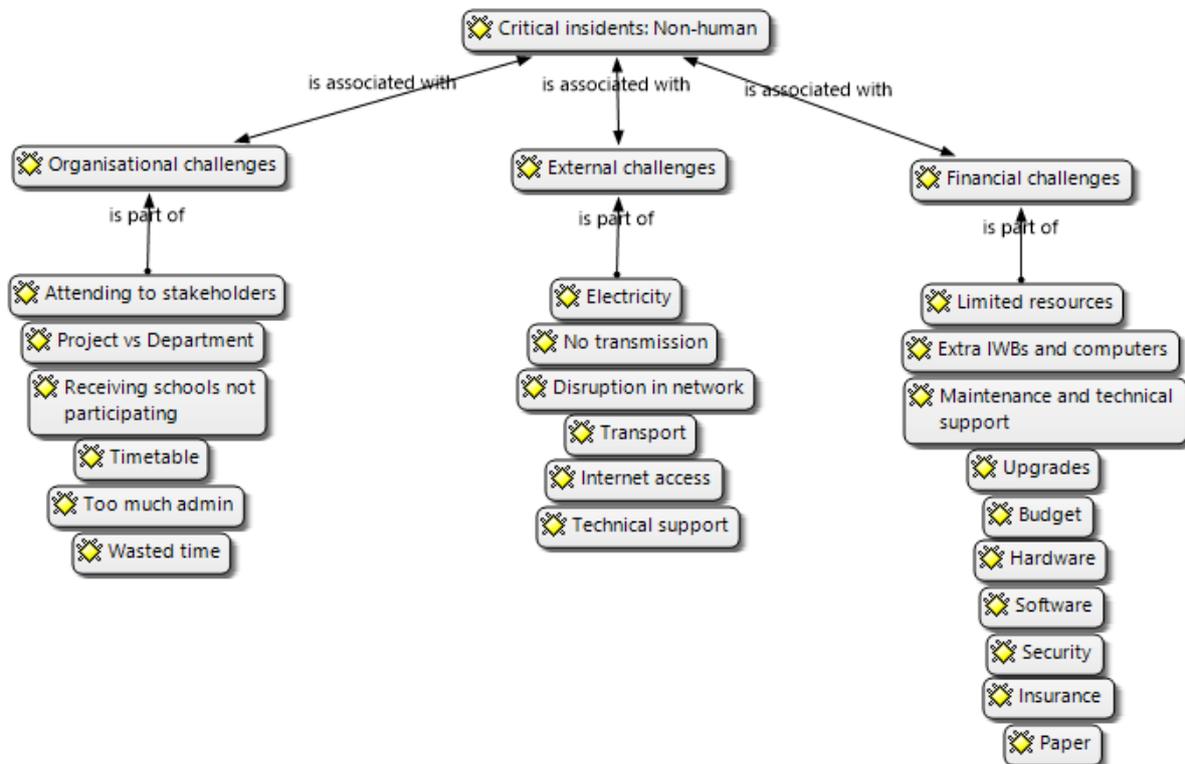
Ralph (rural school principal): *“But the HOD for Natural Science is capable to deal with conflicts whenever they come, because she will always indicate the problem in the beginning of the term: ‘This is how things are going to run in the Department, this is how the project is going to be run, and this is how the district expect us to satisfy their programme as such’.”*

One of the teachers mentioned that she is stressed as a result of the project, because there is limited time to get through the syllabus in grade 12. She suggested that the lessons should only be transmitted to grade 10 and 11 learners, because there is too little time in the grade 12 year.

One of the principals mentioned that the **leaders must be positive**; otherwise the project will not survive.

In figure 4.8, the negative non-human critical incidents are shown, divided into organisational, external and financial challenges.

**Figure 4.8: Negative critical incidents in the project: Non-human challenges**



Some principals encounter **organisational challenges** when visitors for the project come to their schools, having made appointments with the teachers and not with the principals, who may then be **otherwise committed** and not able to see them. Principals also have **departmental commitments**, like unscheduled visits by departmental officials from the head office, and then they need to attend to that and forget about the project. They sometimes also need to take care of other commitments, even when the leading school would like them to concentrate on the project:

William (rural school principal): *“Managerial problems that we sometimes encounter, is when they have plans to do something while I am busy with other things, because there is a lot that the manager of the school is doing, he is not only focusing on one aspect. I might be visited by departmental officials from the head office unannounced. Then of course I should attend that and forget about the project, so that creates a problem, whereas maybe we are supposed to make some submissions on that day and I am unable to do that, or maybe to attend some*

*meeting, and I am unable to attend because I've got my own schedule or meetings that they just scheduled by my seniors.”*

Three rural school principals mentioned that they sometimes have conflicting responsibilities arising from the **programmes of the project and the Department**, while more than one teacher mentioned the same thing. It is mainly a case of teaching different parts of the syllabus so that, when assessments need to be done, the work that needs to be covered is not the same. The Department's pace setter must be followed, and in some cases the schools are giving extra classes to close the loopholes.

**Receiving schools not participating** in the project was seen as a big challenge from the beginning. The representative of the MDoE suggested a solution to this situation, namely that the leading school leader teachers need to develop a programme of sharing the responsibility and accountability to ensure not only the sustainability of the project, but also that knowledge & skills are transferred and mastered.

The rural schools encountered **timetable** challenges and had to change their timetables to suit that of the leading school:

Billy (rural school principal): *“The challenges were with regard to the timetable, because you will understand we are clustered together with this leading school and other schools where we got to make sure that we connect together at the same time, so getting the timetable need to be adjusted to suit that. In this school, we've got more learners, more than 16 or 17 learning areas in a grade, it is complicated”*

The leading school principal also reported that **too much paperwork and administration** was one of the challenges, but it has been resolved.

Wikus (leading school principal): *“Some people don't work that hard. Some people tend to set up a red tape situation where you just did not really can do the work because of too much administration. So it was a lesson that we learnt, not to be busy with red tape, but to be busy with this project, to be busy with the pupils and the teachers, rather than to give all your attention to all the paperwork. Paperwork is very important; we set it up, we stick with that as well, but don't just stay there.”*

Some of the rural schools are also not ready with a back-up plan if there is no transmission as a result of external challenges like electricity and transport, and then the **time** of the double lesson is **wasted**.

**External challenges** necessitate back-up plans to handle the situations when they occur. **Electricity interruptions** in the area are mentioned as a very frequent problem that leads to **no transmission** or a **disruption in the network**. Unreliable **transport** is also a frequent problem in the rural schools and one of the schools has busses coming from six different directions. The transmission is from 8:00 to 9:00 in the mornings, and learners are often late. These problems were alleviated by the leading school saving all the lessons and putting them on the server, so that they can be replayed later. They also function as a useful resource for revision. A lack of **internet access** is also mentioned as a recurring problem that is sometimes due to a lack of electricity, but in other cases, a lack of computers. One school has only two computers, and another, with 1200 learners and 50 teachers, only four. In yet other cases, intermittent internet access may be due to a weak signal or the internet service provider. The leading school is, in most cases, able to provide **technical support** to the rural schools, although there may be a problem with a service provider not coming within 24 hours.

**Financial challenges** are a huge problem in this network, mainly as a result of limited resources. The main role of the project manager of the leading school is to obtain sponsors to finance **extra smart boards, computers, technical support and upgrades**. The rural schools have to budget for extra items as well, with the help of the principals and SGBs. One of the schools even had IWBs installed in the grade 1-6 classes and the principal reports:

Ralph (rural school principal): *"I had challenges as far as the financial situation of the school is concerned, but with the assistance of the school governing body, we had to create a cost item for ICT"*.

The SGBs **budget** for **extra smart boards, hardware, software, security and insurance**. The MDoE pays salaries of staff and helps with a paper budget.

## **4.7 Constant comparison of interviews on the management of the project**

The unit of analysis of this case study is matrix management. My assumption was that a matrix management model would evolve in the six participating schools. In the tables in Appendix C, I indicate the answers given by the participants, in response to some of the questions about management. For the purposes of this study, it was essential to consider the participant's understanding of the type of management structure employed in the project. Data collected were thus also analysed in terms of the management structure that emerged from the interviews with the participants.

### ***4.7.1 Interviews with principals***

One principal reports that they set up a project structure and keep people permanently in posts to run it. In two other schools, there are project coordinators to take care of the project. Others report that the project is established and run by the leading school and they simply have to fit it in their timetable. Two other principals report that the project is run within their school by the HODs or teachers in specific subjects. Most principals reported no confusion or stress; one had a problem with the timetable and two principals identified confusion between the programmes of the project and the Department. Five schools report that they do not have multiple reporting lines; they report vertically to the principal and horizontally to the project manager and administrative officer in the leading school. The leading school reports a matrix system - they have an e-learning committee leading the project (horizontal reporting) and vertical reporting to the principal. The principals expect the HODs and teachers to take responsibility for their own duties in the project. All principals report that the principles of the project are aligned with their mission and vision. The sponsors, project manager and administrative officer play the biggest roles. The SGBs support the project and are mainly in charge of money, security and insurance and to give the green light for the running of the project in the community.

### ***4.7.2 Interviews with teachers***

Most of the teachers agree that they report internally to their HOD and externally to the project manager and mostly the administrative officer (results) of the leading school. One teacher does not report to anybody in her own school concerning e-learning. The Mathematics Literacy teacher from the leading school is responsible

for putting her subject group work on the system and she does not report to anybody. The teachers from the other schools report to her in their subject groups. There is no stress, confusion or conflict - they plan for the whole year during a meeting at the beginning of the year and also sit down with teachers in the same cluster to plan. In most schools, there are not multiple reporting lines. Everybody agrees that they know what their roles are; the teachers from the disadvantaged schools have to ensure that the transmissions take place in their schools. Most teachers agree that they can work with little or no supervision, but the schedules from the Department and project are prescribed and, according to one, it is a situation of working together and coaching one another. Sponsors have a great influence, the administrative officer collects the marks, she sometimes does not understand the teachers' situation, the technicians are very helpful, the project manager is sometimes hard to reach, everybody's role is important and the MDoE is also interested in the project.

#### **4.7.3 Interviews with HODs**

Two of the HODs are from the leading school and they are transmitting lessons to other schools. They are the only ones in their departments responsible for the project and teachers from other schools report to them. The other HODs set aside enough time for the transmissions to take place. They follow the yearly plan and the ICT network is managed like any other learning area. They are in agreement that there was no confusion, stress or conflict caused by multiple reporting lines, because they know what is expected. One teacher mentioned that they are excited by the results of the project. The teachers report to the HODs and, for the marks, to the administrative officer of the leading school. The HODs moderate the marks, and then report to the leading school HODs and teachers transmitting, who are in charge. They also ensure that the teachers get what they need in the network. One of the HODs from a rural school is also transmitting lessons, while the rest must just ensure that the transmissions take place. The teachers in the schools are proud of their work, take responsibility for their results and work together in subject teams. Some teachers give the same class before the transmission to ensure that learners grasp the content, and some are giving extra classes afterwards to close loopholes between the programmes of the project and the Department.

#### **4.7.4 Interviews with SGBs**

I could only interview SGBs of five schools. One SGB member did not know anything about the project existing in their school. The project manager of the leading school emphasised that their SGB is not involved directly in the project (they are just giving the green light) and that it is not necessary to find a member of the SGB to interview. The other four SGBs found it difficult to understand and answer the questions about management.

#### **4.7.5 Interviews with project manager / coordinator**

Two schools reported that they have project coordinators to see that everything to do with the project runs smoothly, but nobody reports to them. One other school has a project organiser, who plays the role of an area reporting person. The leading school has an overall project manager, responsible for the management of the project across school boundaries, as well as an e-learning office staffed by the project manager, administrative officer, an IT specialist and technicians. The reporting lines in the project team are clearly defined, while the project manager determines his own role. At this stage, he is mainly responsible for finding sponsors for the network. The project team is working well in a matrix. Everybody reports to them and the final report goes to the project manager, who gives feedback to his principal and the SGB. The project coordinators manage challenges on a day-to-day basis in their respective schools, and are in partnership with the project manager of the leading school, who assists with maintenance. Reporting lines run from the disadvantaged schools to the leading school and do not cause any stress, conflict or confusion. The rural schools have their own management system and their educators still report to their own principals. The SGBs need feedback and they bought into the project.

#### **4.7.6 Interview with the administrative officer**

The administrative officer also reports that there was no confusion or stress as a result of the year plan and quarterly meetings that everybody works on. Her role is to receive marks reports from the rest of the schools. Everybody knows what they have to do and has an influence on the network by playing their respective roles. The administrative officer and HODs of the leading school are responsible for monitoring the performance of the teachers in the network.

#### **4.7.7 Interview with the representative of the MDoE**

The representative from the MDoE did not experience any conflict or stress as a result of the project. The quarterly meetings minimise uncertainty and the principal's forum plays an important role. Everybody's roles are clearly defined. Teachers from disadvantaged schools took up their roles and responsibilities and are positively engaged. There is just a single reporting line between the MDoE and the principals (or HODs) of each of the schools and communication between them is reciprocal. The SGBs understand their importance in sustaining the project. Sponsors, learners, teachers and the school principal's forum play important roles in the management of the project.

My main conclusion at this stage is that my assumption about a matrix system developing in all schools was incorrect. The disadvantaged schools are still reporting vertically to their HODs and principals, and horizontally to the leading school, but a matrix did not develop in their schools. The traditional hierarchical top-down line management, referred to in figure 2.3, which mainly existed from the 1890s to the 1980s, still exists in the disadvantaged schools. It is a direct and well-defined reporting relationship from the teachers to the Heads of Departments and on to the principal. There are clearly ordered management levels and the lower levels are subordinate to the higher levels. For example, teachers report their marks in all subjects to their HODs, the HODs moderate the marks, and then the HODs report their departmental matters to the principals. Authority is centred in the principals in connection with most school matters, and they have a great deal of control over everyday strategy decisions. However, what makes this project different from other school situations is that the teachers, as well as the HODs, play the active roles in the project, while the principals play a supportive role, mostly getting feedback from the teachers and HODs involved. All the teachers and HODs report in their subject groups to the leading school's HODs who do the transmissions, therefore the teachers are not only answerable to their own HODs and the HODs, in turn, are not only answerable to their own principals. This is not a situation, as is the case in many linear reporting situations, where creativity and innovation are discouraged. Everyone has responsibilities and understands what their responsibilities are in the IWB project and they are valued for the tasks they perform.

A balanced matrix developed in the leading school, having an e-learning committee with a project manager handling the horizontal reporting, while vertical reporting is done to the HODs (functional managers) and the principal.

#### **4.8 Document Analysis**

In the documents collected, one of the stated objectives of the project is to develop a learning environment different to the majority of schools in South Africa and, through using technology, to help teachers and learners to work smarter, not harder. The leading school wants to develop educational technology to improve the teaching competence in schools, to provide knowledge and skills training to learners and teachers, to generate an interest in Science, Maths, ICT and Technology amongst them, and to improve the Mathematics and Science results. The leading school plans to use educational technology to support and develop interactive communication and videoconferencing between schools in the Mpumalanga province and expand it to the rest of Africa. This project has already expanded to three other locations in Mpumalanga. The project supports the MDoE's vision: "Providing quality education and training towards a better life for all".

The most important goal or biggest challenge of this project is to receive better results. Amongst the documents obtained, I received the results of schools, some from 2008 and others from 2010. In 2013, one of the rural schools obtained a 100% grade 12 pass rate, another 90% and another 85.7%. One of the schools, in 2008, had 4 learners passing with admission to a Bachelor's degree, but in 2013, this number had increased to 28. Another school had 10 in 2008, 22 in 2013. One school had a grade 12 Science pass rate of 24% in 2010 and 95% in 2013; one had a Mathematics pass rate of 19% in 2010 and 100% in 2013. Although every year is different, it is clear that this project is already showing signs of bridging the urban-rural digital divide. "The project has proved extremely successful in bridging the urban-rural digital divide, and a positive attitude has been created, especially in rural schools, towards using technology to spread educational material displayed on Smart Board interactive whiteboards. Being able to share quality teaching among geographically dispersed classrooms has had a marked improvement on the quality of lesson content and teaching methodology" (Staff writer, 2009).

One of the questions asked of the interviewees was: What opportunities for professional growth and development were created in the ICT project? All, except one, interviewee agreed that professional growth was evident:

Wilma (leading school HOD): *“I think they are benefiting from it, because they are also learning and teaching at the same time, and as I told you, me as a teacher benefits from it because it makes me sit down and do my work more intensively and spend more time with my subject.”*

PM: *“We saw there is a lot of development from the teachers' side as well. You must remember, when we transmit the lessons, all the teachers from the other schools sits in and they actually listen to the same lesson, so if there were teachers that were not trained to teach grade 11s and 12s, at the same moment they listen to a lesson and get trained without us saying it is a training session”.*

Wikus (leading school principal): *“but also on management level, we found that there was a lot of development for the head masters and senior staff members that was engaged. They all grew because they engaged in a very very good structured project where there was good management, there was a good example set, of management.”*

In a document focussing on “ways of learning”, Maritz (2011) states that the importance of professional development of educators is widely recognised, and the teacher is the learner. Training is not synonymous with professional development, although one of the challenges in this project was inadequate training. Training is narrowly seen as including activities delivered by providers (Maritz, 2011). Another way of learning is assessment by a critical friend, where feedback is received after observation (Maritz, 2011). In the subject groups in this project, such feedback took place. This can also be seen as mentoring a less experienced colleague. Regular opportunities are provided for discussions of goals, sharing of ideas on effective practice and reflection on current practice. Educators are also often brought together to discuss a curriculum, design a programme, solve a problem or plan strategies to solve a particular problem (Maritz, 2011). These discussions also took place in the subject groups in the project.

In a completed Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the project, a lot of challenges were identified similar to those coming to the fore in the interviews. These challenges mainly featured in the beginning of the project. Challenges identified that correspond with the interviews are the following: ICT illiteracy among teachers and learners, no commitment to the project, learners coming late, clashing of timetables, lack of ICT support and guidance from the MDoE, maintenance of the technology, lack of up-to-date technology (future upgrading and sustainability of the project), a lack of school budget to sustain the project, uncertainty where future funds will come from, teachers who are demotivated or afraid to use the technology in the classroom, innovation experienced to be slow, ESKOM load shedding, lack of proper training or continuity, unrealistic expectations and time frames of the stakeholders, security issues and selective involvement of teachers in the programme.

Different ways to reduce challenges were itemised as follows: develop a maintenance and replacement plan and a sustainability strategy, develop a line of communication and flow of information network to all stakeholders, develop a fixed schedule for transmissions, involve other stakeholders, ensure that schools budget on a yearly basis to maintain the project, community ownership of the programme, proper planning and the setting of realistic targets and standards, HODs monitoring content of the project and quality development of teachers through training. These solutions are already incorporated in the project.

In a transformation agenda of the South African Teacher's Union in Mpumalanga, it is stated that implementation of transformation has an impact on the school as an organisation, the learners, the parent community and the teacher in the classroom (Maritz, Swanepoel, Lerm, Ferreira, & Pieterse, 2014). It was evident in this project, with everybody being roped into the transformation process. The goals of the transformation are to close the achievement gap between advantaged and disadvantaged schools and to better the quality, quantity and choices in education. The objectives are to modernise the education and focus on teaching and learning, to adapt to the learner's environment and how he chooses to learn, to digitalise the classroom, provide interactivity, create virtual classrooms, to mobilise education and support learners to learn anytime, anyplace (Maritz et al., 2014). These are

objectives realised in this e-learning project. Schools in partnerships should be developed, as in this network, learning from each other in the context of the world of work, supporting each other, applying best practice, developing networks and sharing risks. The teachers are part of a professional school development network, with mentors in and outside of their schools, implementing best practice (Maritz et al., 2014). This project is an excellent example of what can be expected of transformation in the area.

In the literature review in chapter 2, distributed leadership was discussed as a model worthy of consideration. It was stated that it is inaccurate that a single leader leads schools to greatness (Spillane, 2005). It means generating ideas together, making sense of work in the light of shared beliefs, and creating actions through these new understandings (Harris, 2003). Instead of issuing orders down the chain of command, leaders set the vision and hold followers accountable for achieving it (Rothman, 2009). In “Notes on Self Managing Schools” it is stated that “a totally new approach to educational management, dictated by the devolution of greater powers to school leadership, presently requires different skills and competencies than those needed in the past. The job has become so complex and demanding that the need has arisen for leaders to possess competencies and powers that can ensure the smooth running of their schools and responses to rapidly changing environments” (Maritz, 2014).

In this project, self-managing schools developed. These are defined as schools where significant decentralisation to the school level of authority took place. This decentralisation is a form of authority where the power and ability to make decisions in the domains of budget, infrastructure and instructional programmes are delegated from the MDoE to principals, SMTs, and teachers, while power relating to governance is devolved to SGBs. It means the increase of responsibility and accountability of schools for their overall level of performance (Maritz, 2014). This form of self-managing schools can be compared to distributed leadership and School Based Management. SBM is the systematic decentralisation of authority and responsibility to the school level, where schools are working in a more transparent way. The school community must focus on learning outcomes for learners, school-based human resources, development and the creation of a sense of purpose in

pursuit of quality education (Marishane, 2013). Despite difficulties, teacher leadership can occur if a school puts the appropriate support mechanisms in place and creates the internal conditions for teacher leadership to flourish. Time needs to be set aside for teachers to meet and plan issues such as curriculum matters, developing school-wide plans and collaborating with colleagues. There need to be diverse opportunities for continuous professional development and teachers' self-confidence needs to be improved if they are to act as school leaders (Harris, 2003). In this project, teachers are networking and collaborating with other teachers across school borders on a continuous basis. A lot of professional development takes place through training and using ICT resources bought by sponsors.

Self-managing schools as organisations need to manage their own resources, assume more responsibility for their day-to-day functioning, must work closely with the MDoE, SMT, parents, learners, teachers, and school community to enhance ownership, must develop a school improvement plan to ensure accountability, promote effectiveness and efficiency, and must accept the accountability for learners' promotions and the growing need for continuous professional development of teachers (Maritz, 2014). Evidence indicates that, where distributed leadership is in operation, teachers demonstrate greater professionalism in their role as facilitators of learning and engage openly in professional learning activities. They readily adopt change and cooperative behaviour and demonstrate greater commitment to improve their classroom pedagogy. Teachers engage collaboratively with their colleagues in reviewing existing teaching and learning practices and accept a pronounced role with respect to decision making and participative activities (MacNeill & Silcox, 2006).

Self-managing schools can help to narrow the gap between achievers and non-achievers, as can be seen in the results of this project. An effective self-managing school is a school that promotes progress for all learners beyond the limitations of their socio-economic background, enhances all aspects of learner and teacher development and continually improves from year to year. The self-managing school is a goal driven school, it focuses on teaching and learning, it has a safe and healthy environment, strong instructional leadership with healthy partnerships (Maritz, 2014), as in this project. Where responsibility and leadership are distributed throughout an organisation, it is more likely that sustained change will be achieved. Common

values lead to the view that it is desirable to solve problems by agreement (Bush, 2006). Participation can only be established with the support of the principal and the effectiveness of the system depends on the attitudes of staff (Bush, 2006).

#### **4.9 Conclusion**

In this chapter, I have presented the analysed data. Matrix management was discussed as a possible management model used in this project and certain a priori codes, namely budgeting, planning, organising, directing, controlling, motivating and staffing, communicating and co-ordinating were used first to analyse the data. It emerged from the data that it could be divided into data dealing with management changes and management challenges. The management changes were divided into administrative, resources, teachers' and principals' changes. The management challenges were firstly divided into management challenges in the rural and leading schools. Rural school challenges were discussed under principals' and teachers' challenges, while leading school challenges were discussed under challenges reported by rural schools, goals and challenges occurring in the management of the project. Critical incidents occurring in the project were discussed under positive incidents and challenges. Data collected were also analysed in terms of the management structure emerging from the interviews. I compared the answers of the interviewees regarding management with each other, a technique called constant comparison.

In chapter 5, I will discuss the second sub-research question, as well as conclusions I made as a result of this study and recommendations for further research.

## Chapter 5: Recommendations and Conclusions

### 5.1 Introduction

As stated earlier, I was part of the initial research conducted on the leading school's e-learning network and gained a keen interest in the project, as the learners and the management members were very positive about the project. From the outset, I was intrigued by the management challenges that required an approach that would deviate from the traditional line function approach. Each school retained its own management and governance structures, but had to create the possibility of managing the ICT network across traditional boundaries. The purpose of my research was to determine the key managerial challenges and type of management approach that developed during the implementation of the network and to determine the influence of various role players such as the project manager, school principals, SGBs, HODs, project coordinators and educators on the network. I wanted to examine the relationships between the different role players and how they used their power to influence others and to contribute to the success or failure of the network. I also wanted to discover the possible contribution that the lessons learnt from the case study could have towards management theory regarding the management of ICT in similar multi-school models. The research questions that I wanted to answer were:

#### ***Main research question***

What are the key managerial challenges faced in implementing an inter-school ICT network?

#### ***Sub research questions***

- a) What is/are the possible management model(s) that may be used in managing an ICT network involving numerous schools?
- b) What type of management approach developed during the implementation of the ICT network?
- c) What critical incidents occurred during the life span of the project that had an effect on the management of the project?

- d) What is the possible contribution that the lessons learnt from the case study could have towards management theory regarding the management of ICT in similar multi-school models?

This chapter sets out to triangulate the data with the literature review and to discuss the findings as they pertain to the research questions in chapter 1. These are now presented again, in summary. The chapter makes recommendations for further research and ends with a final conclusion.

## **5.2 Discussion of the main findings**

### ***5.2.1 Triangulation of the data with the literature review***

ICTs affect all spheres of our lives and are an indispensable tool to function in modern society (Anderson, 2010). While education has been slow to respond to new possibilities created through technology (Beeby, 1966), this IWB network changed the lives of all involved, specifically those in the rural schools, who did not even have internet access before and depended on old magazines to bring the outside world into the classroom. According to Chigona and Chigona, (2010), factors that affect the use of ICTs negatively include a low level of ICT literacy among teachers, insufficient ICT training, lack of confidence, inadequate technical support and fear of using technology. All these factors existed in the rural schools. There are vastly different levels of implementation and integration of ICTs in education (Tinio, 2003), and before the project was initiated, huge disparities existed between the leading school and the rural schools. It is also difficult for rural schools to attract suitable teachers, especially for grade 12 learners.

With the project in operation, the schools receive the same quality of education in Mathematics and Science for grade 12 and 11 learners, because they have access to the same teacher during the transmissions, and the same notes are distributed between the schools. With the implementation of the IWB network, the teachers received training from the leading school in the most effective approaches to take advantage of the technology (NCTE., 2008). It boosted their confidence and helped them to overcome their fears. School-level barriers like the lack of suitable educational software, old or poorly maintained hardware and absence of technical support (Becta, 2004), were also overcome: new IWBs and computers were given to

schools, along with software packages suitable for the South African curriculum, and the leading school provided technical support. Traditional assessment was modified to incorporate common assessment practices between all schools. Developing high quality teaching materials represented a significant addition to the workload of the teachers of the leading school since they have to improve the content and presentation of lessons constantly.

People in rural areas are often stereotyped in ways that emphasise their powerlessness (DoE, 2005), but in this project, the investment in human capital prepared the learners of the disadvantaged schools involved in the project for a better future, where many more passed and even obtained bursaries to study further for employment outside the field of primary agricultural production.

The on-going infusion of ICTs in schools has placed pressure on SMTs to address reform and make ICTs a priority in schools. In the leading school, the learning system can be judged by the state of the art equipment, with each class having an IWB, and teachers able to print learning materials from their classrooms. The disadvantaged schools received at least one IWB system each through sponsor money and they are budgeting for more computers and IWBs. The use of the IWBs appeals to multiple senses and suits different learning styles, as well as a range of teaching styles (NCTE, 2008) and thus supports teaching and learning.

Technology integration is not only about technology, but about focusing on leading teachers to change pedagogy and support future generations with 21<sup>st</sup> century teaching and learning strategies that increase learner achievement (Kozloski, 2006). The technology increased learner engagement, promoted the development of 21<sup>st</sup> century skills, raised the level of learner achievement, developed a culture of collaboration between the teachers, and shared leadership and positive relationships with the community (Levin and Schum, 2012). Science benefitted most in the project, as experiments became more accessible, and schools without laboratories experienced the positive impact of this most of all.

Schools are likely to be much more effective if they are well managed (Bush and Coleman, 2000). The project survived numerous challenges, but remained strong and has been growing over time. The hardware and software are in place and,

although the system can suffer electricity interruptions and other breakdowns, the human factor is much more unpredictable. Successful ICT projects are the exception rather than the rule (Lang, 2007), and the fact that this one survived can mainly be attributed to good management. Each school retained its own management structure, but had to create the possibility of managing the ICT network across school boundaries.

In this project, it is the task of the project manager to plan, organise and coordinate. He is also responsible for problem solving and measuring the performance of the staff involved in the project. He has to communicate with those staff members and ensure that the project produces useful change in the disadvantaged schools and in the lives of all the teachers and learners concerned. Change requires effective management (Bush & Coleman, 2000). The project manager is responsible for the ICTs and equipment. He is an effective manager, and therefore chooses the right goals to pursue and utilises resources efficiently (Jones & George, 2005). The ability to co-ordinate and mould individuals into cohesive teams distinguishes effective from ineffective managers (Jones & George, 2005). He plays the role of a liaison, networking on behalf of the organisation, and monitors the project members in terms of productivity and well-being. He is a disseminator, communicating useful information to the team, and the spokesperson for everybody involved in the network. In bringing about change, he is an entrepreneur and a disturbance handler, responsible for corrective action. He is the resource allocator, allocating funding, assigning staff and other resources and negotiating for the team (Mintzberg, 1989). Certain consecutive actions are present in management that fulfil the objectives of an organisation. These actions form a continuous cycle of planning, organising, leading, and controlling people, objectives and resources – resources that are human, financial and physical (Van der Westhuizen, 1995).

The administrative officer also fulfils the role of a liaison and disseminator. She monitors the progress of the schools in the network and communicates to all the schools in quarterly meetings. She is responsible for managing the yearly plan. She is also responsible for problem solving and measuring the performance of the staff involved in the project.

The principals function in the role of leaders and it is their task to inspire and motivate. Their leadership also includes the responsibility for managing. They are responsible for the mission and vision of their schools, and they have to align their staff to that vision. The vision needs to be specific to a school and refers to a desirable future state of the school; it clarifies the direction to be taken by the school and relates to its intended purposes (Bush and Coleman, 2000). School principals also need to address governance, culture, curriculum and instructional strategies, learner's expectations and responsibilities, assessment and evaluation and communication and relationships within the school community (Levin and Scum, 2012). Strategic management is exercised by the principal working with the SGB. The principals are also leaders responsible for budgeting, staffing, problem solving and measuring performance. The principal is the figurehead in the school, having social and legal responsibilities (Mintzberg, 1989). They have a considerable impact on the school's organisational and social culture and are key facilitators in assisting teachers to improve teaching practices, like the implementation of ICT (Schiller, 2011). In this project, ICTs are successfully implemented because the principals actively support it.

The HODs of the leading school are responsible for managing the staff in their subject groups. They are leaders of other staff members and, as such, are responsible for corrective action and problem solving in their subject groups. They are also responsible for a higher standard of education and the improvement of lesson content and teaching methodology.

For the ICT network to be successful, effective, visionary and inspirational leadership is needed, as well as effective management in terms of achieving goals and objectives.

Although a matrix did not form in all schools, some of the criteria of a matrix are applicable to this case. This project helped to increase the levels of **efficiency** in the use of technology in the different schools. **Accountability** was very important too, as it reached across school lines, with the rural schools being accountable to their own principals and HODs, but also to the HODs, administrative officer and project manager of the leading school. As a result of manifold accountability, there are many levels of **coordination** impinging on meetings and transmissions, as well as use of

resources like IWBs, computers, and sponsor money. **Adaptation** is the rapid response to changes in the organisation's environment, like the availability and usage of the ICTs. The criterion of **social effectiveness** refers to a variety of social needs that the project satisfies. Most interviewees reported no conflict, stress or confusion in the project, but professional development and motivation (Knight, 1979b).

In this project, teachers are members of more than one group, namely the IWB project team led by the project manager of the leading school and the Science or Mathematics departments led by the HODs. These groups are both work-related and their constitution is based on the need to get the organisation's work done and they are operating in highly technological settings.

There are certain success criteria for a matrix that are also evident in this project, like dynamic leadership and management, clarity in roles and responsibilities and the use of resources, training and professional development, collaborative and purposeful behaviour and workplace agility enabled through infrastructure (Bell, 2004). A balanced matrix developed in the leading school, where the project manager is responsible for what has to be accomplished and when, while functional managers are concerned with how it will be accomplished. In this project, the project manager oversees the project and he interacts with the principals, SGBs, administrative officer, functional managers (HODs) and teachers.

The project did not take over the workers from the functional departments; they have a responsibility to both the project and the functional department, but resources from functional departments are used in the project, like teaching and assessment skills in Science and Mathematics. Individuals are using their skills in a variety of contexts (Riley, 2012). Teams and individuals are setting up their own goals and work schedules without being constantly supervised. This frees up management time and allows for creative and flexible approaches (Corkindale, 2008). Inattentive managers will cause stress and overwork, something that did not happen in this project. The attentive project manager offers opportunities for professional growth. The project manager and functional managers know their roles and responsibilities. The project can suffer if there is any doubt about the responsibilities of the functional and project managers, but it did not happen in this project. There are clear job descriptions, no

personal conflicts between leaders, no lack of trust between employees, sufficient communication between different teachers, and no ambiguous roles or confusion about who has the final authority (Sy & D'Annunzio, 2005).

The IWB network has changed the lives of all involved, especially through training for the teachers and better results for the learners. The use of the IWBs supports teaching and learning in a 21<sup>st</sup> century environment. The project is well managed by the project manager, administrative officer, principals and HODs.

### ***5.2.2 The key management challenges in the project***

According to the data presented in chapter 4, the main challenges of the rural schools are teachers' and principals' challenges, as well as challenges with resources. The data revealed that the fact that the programme of the Department and the project sometimes cover different stages of the curriculum is one of the main challenges of the rural schools. This challenge can be overcome by the further involvement of the leading school. They can plan to keep the pacesetter of the Department on par with the work being taught in the project.

The increased workload on teachers is a given, due to more assessment and more marking, in addition to re-teaching of learners, where necessary, if they do not understand the work as it is taught the first time by the teacher of the leading school. Although it is a challenge, the extra assessments help the learners to understand the work better and obtain better results, and are one of the main reasons why the project is so successful. Re-teaching of learners that did not understand is necessary in any school environment.

The project limits the time to get through the syllabus, as a result of the hour-long transmissions on Mondays, Tuesdays and Thursdays. On Mondays and Tuesdays the grade 12's receive lessons in Science and Mathematics or Mathematics Literacy, and the Thursdays are used for the grade 11's. The teachers need to plan around this and also ensure that time is not wasted with electricity interruptions. In the event of power outages, they need to be ready with their own prepared lesson and have chalk available.

Some teachers are scared of the new technology, but regular training sessions help them to overcome the fear. The leading school budgets for and arranges the training, and very few people are of the opinion that the training is inadequate. The fact that the rural school teachers sit in the classes when the transmissions are done is also helping those with a lack of experience in teaching grade 12's or inadequate Maths and Science background. Most of the rural school teachers are satisfied that the transmissions are done by the leading school.

The project manager of the leading school should appoint someone in his place if he is not available. It is not enough to leave the organisation of a project of this magnitude in the hands of the administrative officer or technicians.

The principals' main challenge is a lack of money for resources. The different schools face problems in managing ever-growing networks of computers with limited resources. Limited budgets need to be balanced against the need for secure, current technology. A systematic plan to refresh outdated technology exists on the side of the leading school. The other significant challenge of rural school principals has to do with teacher shortages, teacher absenteeism and teacher turnover. This project is helping principals to motivate their teachers. They are less absent than in the past and also learn during transmissions. They are proud to be associated with a project of this magnitude. Teachers teaching other subjects want to become a part of the success story as well. If staff members leave and are replaced, the new teachers are trained by the leading school.

The leading school's challenges are on another level to that of the rural schools. They have to recognise the challenges of the rural schools and plan to alleviate them in the future. They have a set of goals for the project, all of which have already been achieved. The primary goal remains to strive every year for better results, mainly a 100% pass rate in the subjects involved, with more and more bursaries allocated to deserving students. Even according to the representative of the MDoE, this project has reached capacity, but it stays an important goal to start a network like this in other areas of Mpumalanga and eventually the whole country.

The teachers of the leading school all mentioned an increased workload, but they are not complaining about it. They report that it is getting easier each year, when one simply adapts the lessons, tests and exams that have already been prepared. They have to adapt lessons again to cater for the CAPS syllabus. All the leading school teachers transmitting the lessons are very positive about and very thorough in their jobs.

The establishment of an e-learning office alleviated most of the administrative challenges. In this office, the administrative officer handles the challenges of the statistics of the project, something the project manager had to do in the past, but he is now free to concentrate on obtaining sponsors for more IWBs and computers, training, maintenance and technical support.

To summarise, the main challenges of the rural schools are teachers' and principals' challenges. The teachers find it difficult if, at a specific time, the topic covered in the project differs to the topic required by the Department's schedule. They are experiencing an increased workload, mainly as a result of more assessments, more marking and the new syllabus. They have limited time to cover the syllabus. Some teachers are scared of the new technology. Principals are mainly experiencing challenges with resources and their teachers, as a result of absenteeism or turnover. The leading school's teachers are all experiencing an increased workload. The goals of the project, training, and finding of sponsors, maintenance and technical support can also be seen as challenges.

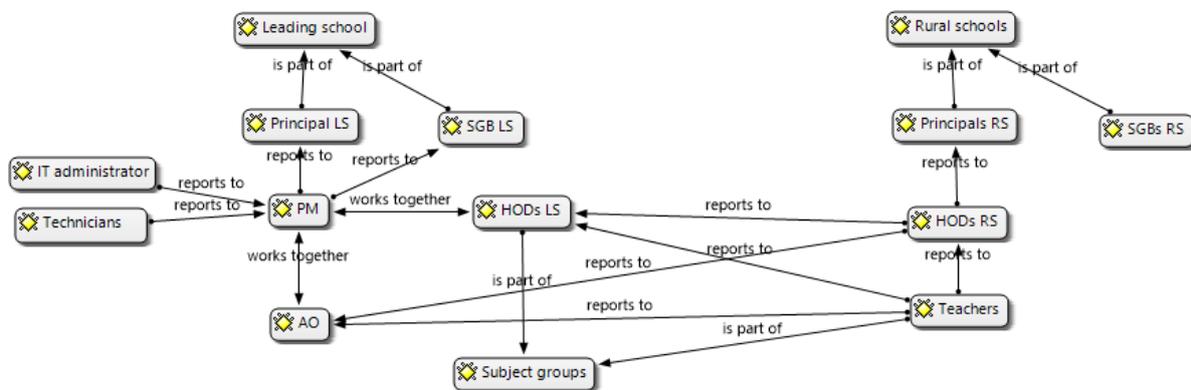
### ***5.2.3 The possible management model in this study***

According to the principal of the leading school, a matrix system evolved in his school. They set up a steering committee where every role player sat down and could explain his or her needs, and take individual responsibility for his or her role in the project.

In the other schools, reporting takes place to the project team of the leading school across school boundaries, but in their own schools, the reporting stayed mostly the same as before, namely linear reporting from teachers to HODs to principals.

The model that developed is depicted in figure 5.1.

**Figure 5.1: The management model in a network of six Mpumalanga schools**



In figure 5.1 the real reporting lines of the role players are displayed. In the leading school, the SGB, principal, project manager, administrative officer, HODs, a teacher, the IT administrator and technicians are involved in the project. The SGB is just involved in a monetary capacity and expects feedback from the project manager. The final reports of the project manager are going to the principal and SGB. The principal is described as very knowledgeable about the project and his buy-in is described as very important by everybody involved. The principals and SGBs are also in charge of their school budgets. They have to decide, for example, if old computers will be maintained or if new ones will be bought. If the SGB is buying into a project, the community buys into it as well. Every step is monitored and debated, approved or disapproved. One of the principals mentioned that the SGBs are mainly in charge of things like the security and insurance of the equipment that they received from the sponsors.

The project manager is driving the project. This project is his brainchild, and he has the right balance of technical project management and people skills. He sets his own goals and is making the overall decisions about everything. In the beginning of the project, he managed all the tasks, but now he has a project team to help him and the reports from the administrative officer, IT administrator and technicians go to him. He has to ensure that all team members are clear on the chain of authority. His current role is to find sponsors and to give feedback to the sponsors. He handles the marketing of the project, and according to one teacher he is sometimes not available as he is frequently out of the country. The project manager took over the full

responsibility for the project management within the constraints of their school budget and sponsor money. The project draws expert teachers and their skills from the functional departments, i.e. the Science and Maths departments and, by doing so, it is breaking down departmental barriers and allowing individuals to use their particular skills in the project (Riley, 2012).

All the administrative reports in the project go to the administrative officer, as well as most of the reports of the teachers and HODs. All the results from common tests are sent to her before the meetings, so that she can analyse them and determine whether there has been an improvement or not, a mechanism that effectively also monitors the teachers' progress. She ensures that everybody knows the schedules and gets their calendars, and she handles any administrative complaints. According to the project manager, she is playing a key role, and his words are echoed by all the teachers. Only one teacher commented that the AO does not understand the teachers' challenges; she just wants the marks when it suits her.

The IT administrator and technicians report to the project manager. The same staff that is responsible for development is also responsible for support services. The technician does the physical work, the upgrades of everything or putting in new computers or IWBs. The IT administrator is knowledgeable about the operation of the computer itself and how to do the network administration.

The HODs of the leading school, one of the teachers at the leading school, and one rural teacher (for Mathematics Literacy) handle the transmissions of the lessons. They formed subject groups for their subjects, and the teachers and HODs of the rural schools report to them in their subject groups. The teachers of the rural schools also report to their respective HODs, both of whom report to their principals. According to the representative of the MDoE this cannot be done by outsiders. The rural schools have their own school management system. The principals tell them how to manage their classes and the project is just there as extra help for them. The principals must be very positive; otherwise it would be a struggle to keep the project running. Only one teacher said that she is not reporting to her principal regarding the e-learning project.

In two rural schools, project coordinators have been appointed for the project, but the teachers do not report to them. These project coordinators report to the principals and are in charge of the equipment and ensuring that lesson transmissions happen on schedule. One project coordinator reported that he sees himself as a forerunner of every lesson. He has to ensure that the systems are up and running and that everything is communicated properly.

In summary, a matrix system evolved in the leading school, with dual reporting lines - vertically to the principal, and horizontally to the project manager. The project manager and the administrative officer play the main roles in the reporting process. HODs in the leading school are leaders of subject groups. In the rural schools, reporting takes place to the project team of the leading school across school boundaries, but in their own schools, the reporting stayed mostly the same as before. The management in the rural schools can be seen as a hybrid form. A hybrid is the offspring of two parents differing in one or more characteristics, a living thing that has the ability to act or function independently (Freedictionary.com., 2008). The rural schools did not develop a matrix management system, but kept their linear reporting format, from the teachers to HODs, to the principals.

Hegemony means the success of the dominant classes in presenting their view of the world in such a way that it is accepted by others as common sense. The consensus then is that it is the only sensible way of seeing reality. The subordinate groups spontaneously consent to the domination, which they believe will serve their interest (Washingtonedu., 2014). According to Palmer (2012), hegemony is a big word for a fairly simple idea. When socially powerful people use their influence to convince less powerful people it is in their interest to do what is in the most powerful people's interest, it is hegemony (Palmer, 2012). In this project, the leading school is influencing the rural schools to accept an idea which originated, was coordinated and initiated and is monitored from their side, as a powerful and positive influence in their schools. In this case, the influence from the leading school is very positive and most of the interviewees were in agreement that the cooperation did not cause any stress. Here are some quotes indicating that the ideas of the leading school were accepted by the rural schools:

Wikus (leading school principal): *“if you focus on money, you find people will engage in struggles, engage in side-lines, but if you focus purely on the benefit of the pupil you’re working with, as well as the benefit of the teachers involved, you will find that people won’t focus on themselves, and you will not struggle with this one. People were so grateful about what’s happening they all worked together. I think people just read your deed. When they see what you are doing, they see that it is honest people and they are really not there for the money, but for the children and the teachers.”*

*“People really think that there will be problems if you go to other people and try to teach them and try to help them, because they may feel they are the bad guys and we are the good guys, and they are the people that are less intelligent and that we are intelligent, but that is not so, if you focus on the right things, you stick to the good values, and you create trust, before you start with anything. By just sticking with everything you said you are going to do, you find that people on this trust level will engage in the project.”*

Ralph (rural school principal): *“The mother body, they monitor us, the whole cluster. We submit marks quarterly and the tests that are written through the month, we must submit. Lesson plans come from them as well, loans come from the mother body, so through the submission of the marks they monitor us, as to the learners are progressing.”*

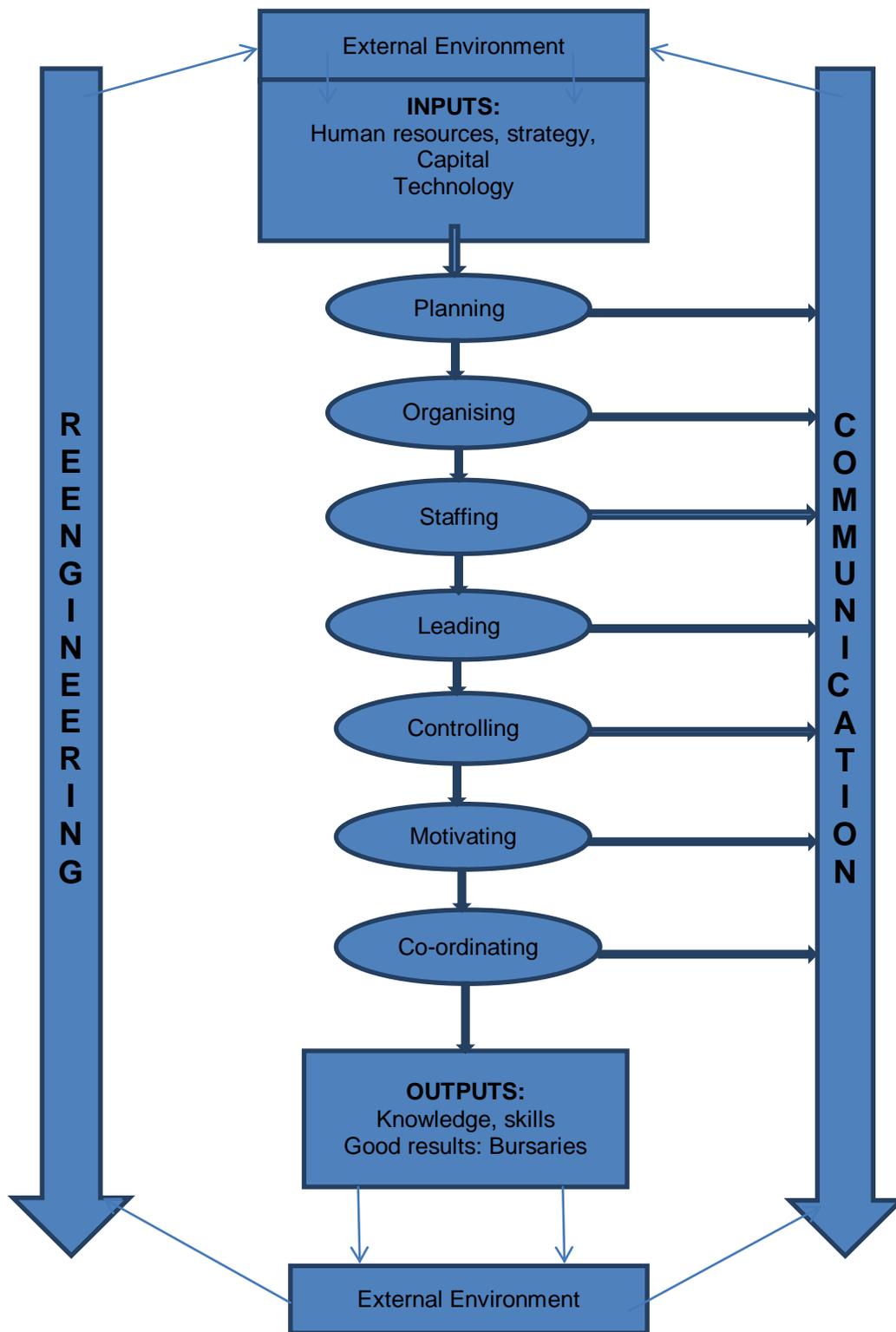
Billy (rural school principal): *“As the rural school, advantages like this is very much for a school like the leading school to do something like this is pioneering work, and how this school sometimes have trouble in these days just paying school fees, because the pressure is very hard. It is not something that I can understand, that the benefits of the school are not only for their own people, that they are looking out for the kids of other less fortunate parents, and something like that is emotional for me to see my children benefit from this project.”*

#### **5.2.4 Type of management approach**

A systems management approach developed in this network. This was already discussed in chapter 2. It is a set of different independent parts working together in an interrelated manner, namely the **input** and **process** working together to accomplish **outputs**. In this case, the **inputs** are the staff involved (principals, SGBs, project manager, administrative officer, HODs, teachers), the strategy (plans for

allocation of resources), management style, capital input like sponsor money and school budgets, as well as the technology, namely the IWBs and computers. The **process** refers to activities related to management, namely the planning, organising, staffing, leading, controlling, motivating and co-ordinating in this network. **Outputs** are the knowledge and skills acquired by teachers and learners as a result of the transmissions in Science, Mathematics and Mathematics Literacy, a better pass rate for learners and, as a result of that, bursaries awarded to learners. In figure 5.2 the systems approach like used in this network, is depicted.

**Figure 5.2: Systems approach in the IWB network**



Adapted from: [http://www.slideshare.net/rakshith216/systems-approach-to-management-14871396?next\\_slideshow=1](http://www.slideshare.net/rakshith216/systems-approach-to-management-14871396?next_slideshow=1)

Planning in this network is mostly done by the project manager, administrative officer and HODs doing transmissions, planning for things like transmission time, common assessments, getting the marks, and upgrades, etcetera. During organising, the resources are brought together to achieve objectives, which determines the part each member of the organisation needs to perform and the specific activities required to accomplish planned goals. Leading deals with instructing people in the right way. The principals, project manager, administrative officer and HODs are all performing leading roles. Controlling encompasses the assessment and evaluation of tasks. Motivating involves leaders encouraging people to pay more interest to the work assigned. Staffing is the manpower needed for the execution of the management plan and is mainly the task of the principals. Co-ordinating is ensuring that the resources are used most efficiently. Communication is linked to, and part of all these aspects. It must take place in all areas and between all the people assigned to the project. This is an open system, meaning that it is interacting with the environment as well and the system is re-engineering itself as a result of the feedback between all sub-parts. The system guides managers in the analysing of problems and in the developing of an integrated approach.

### ***5.2.5 Critical incidents in the project***

Critical incidents in this project fall into two categories: positive events that affirm the success of the venture, and stumbling blocks that threaten its sustainability, but which challenge the role players to successfully overcome them.

The different role players all had a positive impact on the project in different ways. The project manager plays the pivotal role, since he initiated it and has been in charge of the project since 2008. The principal of the leading school incorporated the ICT project as part of the school's business plan. All principals made it part of each of their school's mission and vision. The position of administrative officer was created to handle the administration of six schools' results, meetings, infrastructure and yearly plans. The HODs of the leading school were chosen to handle the transmissions and it was decided that the teachers and HODs of disadvantaged schools should report to the HODs of the leading school in subject groups. The e-learning project office was established to handle the high volume of administrative

work and made a huge difference in the running of the project. Sponsors set up a complete IWB network in all schools involved.

Teachers are experiencing many critical incidents affecting their participation in the project, like an increased workload, being afraid of new things, limited time and limited professional development. They also report on incidents affecting the learners, also being scared of new things, a lack of participation and not paying attention during the transmissions. Some teachers experience stress in the project, mainly as a result of limited time to finish the syllabus.

Organisational challenges also occurred. The MDoE withdrew its support for the project, and the schools needed to find other ways of continuing, mainly through sponsor money obtained by the project manager. Some schools reported security issues like break-ins leading to the replacement of equipment. This was managed through budgeting by the rural schools and money for maintenance coming from sponsors. Financial challenges are experienced in every school. A careful budget must be drawn up to take care of things like insurance, security, extra IWBs, paper and maintenance and upgrades in hardware and software.

Fitting in the project transmissions into the schools' timetables was managed by the rural schools' principals and all reported that it was done, except for one school that does not receive grade 11 transmissions. Wasted time as a result of external challenges like electricity interruptions are also reported. The recording of transmissions in order for rural schools to play transmissions later when it suits them is alleviating this problem, although the rural school teachers themselves need to take care that the transmission time is not wasted when there are electricity interruptions. Problems with transport coming late and no internet access are also causing disruptions in the network.

The abovementioned incidents should lead to an understanding of the complexity of the management of this system.

### **5.2.6 The possible contribution of this case study to management theory**

I examined the relationships between the different role players and how they used their power to influence others to contribute to the success or failure of the network. I discovered the contribution that the lessons learnt from the case study could have on management theory in the context of ICT management in similar multi-school models. As part of my investigation, I came to an understanding of how the participants constructed their perceptions of the management in an IWB network.

This study's first contribution is through its use of a balanced type of matrix management model in the leading school. Hierarchical organisations benefit many state organisations and institutions like schools. In this project, the disadvantaged schools' organisation is mostly hierarchical, but the project was also managed across a number of schools within the bureaucratic system - dynamic, diverse, distributed and technically complex activities had to be managed (Sy & D'Annunzio, 2005).

The SGBs of the rural schools are not very firmly established, but they are very positive about the project. They allowed the project in the schools and visit the schools to see how it is developing. All the SGBs are in control of the school budgets together with the principals. They are in charge of the security, insurance and buying extra IWBs. The SGB of the leading school only wants feedback from the project.

The leading school's principal is at the top of the basic matrix structure and has a clear perspective of all activities and staff in the matrix. He has to allocate both project and functional budgets, set the standards of expected performance, but also delegate (Adams & Kirchof, 1984). He also plays the leading role in technology integration. The interventions of all the principals have a considerable impact on the teachers' implementation of ICT (Schiller, 2011). Transformational leadership behaviours of principals play a crucial role in technology integration into the curriculum (Betz, 2000). The principals allow time to undergo training, undergo training themselves, show commitment to the long term investment in technology, and encourage staff to create, demonstrate and reflect in collaborative groups (Bannister, 2010). Because managers are the people who decide how to use the organisation's resources like its employees, financial assets, computers and

information systems, their decisions directly impact on the socio-economic situation of a society (Jones & George, 2005).

Deciding on the vision and mission of a school is at the heart of educational management, and the use of ICT in a school has to be aligned with that vision and mission and support it. The management, mainly the SGB and principal, decided on the aims of the organisation and the use of its resources. Effective managers are those who choose the right organisational goals to pursue and utilise resources effectively (Jones & George, 2005). Change needs effective management and, in this case, technology has been an effective catalyst for change (Levin & Scum, 2012). A key factor for an effective school is firm and purposeful leadership from a leading professional, but with a participatory approach (Imison & Taylor, 2001), like in this project.

Management in this project is not confined to the principal. The principals, SGBs, and the project manager of the leading school are the senior managers. HODs are subject group leaders and functional managers. Classroom teachers in the rural schools mostly report to five managers in this project, namely their HODs and principals in their own schools, and the HODs, administrative officer and project manager in the leading school. The project manager of the leading school is not acting on the same level as the functional managers, as he would in a balanced matrix. The project manager reports to his principal and SGB, but has a lot of power, since this project is his “brain child” (according to one of the principals). The project manager in the leading school is responsible for what, when and how things have to be accomplished and is the overall manager, giving feedback only to his principal and SGB. In this project, the project manager is responsible for a clear project plan to reach performance targets, determining resource budgets, managing project risks, sustaining a focussed and committed team, creating the team’s operating practices, monitoring performance against plans, resolving interpersonal conflicts as well as project issues and problems, and controlling project changes (Portny, 2013). Decisions on promotions and job assignments are influenced by the project manager and he uses his knowledge, competence, personality and group management skills to get the project’s tasks accomplished within budget, on time and within performance standards (Adam & Kirchof, 1984).

According to Bannister (2010), choosing the right person to lead the implementation of IWBs within an organisation is vital to its success. One of the rural school principals says that you need a good manager to take the responsibility for a project like this. If that person does not exist, the project cannot go ahead. According to the leading school principal, they set up a steering committee for the project, where every role player's needs and responsibilities were determined. The representative of the MDoE also reiterated the importance of a steering committee for this project.

In the 1990's, the matrix evolved into a highly dynamic work system with organic work flow. In this network, the decision-making around the ICT project migrated away from traditionally centralised management structures and devolved instead upon the task, being assigned to a project manager in the leading school. This action acknowledges that the project orientation is too important to be treated as a secondary concern by functional managers (Kolodny, 1979). The introduction of new technology presented complex opportunities and challenges for the schools, leading to changes in managerial practices and the emergence of new organisational forms (Liam, 2011). High self-accountability, self-responsibility, adaptability and personal development are key values that enable mutual commitment among organic organisational members (Kantabutra & Suriyankietkaew, 2012, Dorczak, 2011). The manner, type and quality of interaction among individuals fostered a sense of a learning community, where teachers participate in decision-making, have a shared sense of purpose, engage in collaborative work and accept responsibility for the outcomes (Harris, 2003). A highly effective project-based organisation was developed, designed to deal with complexity. It is an adaptive form of organisation that is able to fuse professionals with varied skills and knowledge into project teams for solving complex and often uncertain problems (Liam, 2011).

The study also contributed by being an organic management system that uses distributed leadership and SBM. In distributed leadership, leadership practice can be distributed across two or more leaders who work separately, but interdependently. In this project, leadership was distributed between the leading school principal, the project leader, administrative officer and HODs from the leading school. It was also distributed between the rural school principals and their HODs. Leadership practice takes shape in the interactions between people and their situation, not from the

actions of an individual leader (Spillane, 2004). Leaders set the vision and hold followers accountable for achieving it (Rothman, 2009). Time is set aside for teachers to meet and plan issues such as curriculum matters, developing school-wide plans and collaborating with colleagues (Harris, 2003). There are opportunities for professional development in this network, and teachers demonstrate greater professionalism in their role as facilitators of learning.

The authority of the Department is decentralised, awarding a degree of autonomy to schools in order to improve education. This affects areas like physical, human and financial resources, power, knowledge and skills, time, technology and information and the school's active involvement in self-improvement activities, forging external relations between the school and community. The schools develop their own visions and missions and mechanisms of measuring performance (Marishane, 2013). The strategy focuses on the preparation and support of trained teachers, the fostering of leaders, and the availability of learning materials (Fullan and Watson, 1999). For the teachers, SBM has taken the form of professional development that deals with assessment and curriculum design. When schools in a system where SBM has been implemented, are working together in powerful networks, the opportunity for learning across the system is enhanced (Caldwell, 2005). The schools in this project developed just such a network, and it benefitted learners in all six schools, especially the previously disadvantaged schools that were able to integrate the use of IWBs into their curriculum for the first time. All teachers have goals and accountabilities, policies and standards around the use of the IWBs were created and a network of support exists through training, maintenance, meetings and technical problem solving.

Similar multi-school models will develop in the same way. We can expect that there will be an overall program manager from the leading school. There will be a steering committee in the leading school, with an administrative officer, IT administrator(s) and technicians. The project manager will report to the SGB (mainly giving feedback) and principal. In the rural schools, there will be a SGB in charge of the budget and responsibility for the budget will be handled by both the principal and the SGB. In each school, there should be a project coordinator or manager, but it will not necessarily be a formal position; it may just be somebody responsible for the

hardware or ensuring that the transmissions take place without any hassles. Horizontal reporting to the project manager and administrative officer will take place across schools and within the leading school. Vertical reporting takes place to the HODs and to the principals. A balanced matrix will develop in the leading school, but also organic management, distributed leadership and SBM.

### **5.3 Recommendations for further research**

ICT integration in South African schools is not yet realised (Leonard & Leonard, 2006), and educational technology has little direct relationship with the aims of the curriculum (Mercer, et al., 2011). In South Africa, we need more research into ICT integration in education and in the curriculum specifically, as well as the disparities between developed and developing countries and the bridging of the urban-rural divide. The project studied in this case is extremely successful in bridging this divide, and an excellent model for other South African provinces to emulate. It uses 21<sup>st</sup> century technology to help disadvantaged schools to uplift the standard of teaching and learning and improve their results. Although there are limited resources in rural areas, there are pockets of innovation that warrant further investigation, like the expansion of this IWB project into other areas in Mpumalanga. In this study, I concentrated on the use of the IWB, but research on the use of mobile technology like iPads and response systems used by learners to indicate their level of understanding, is also needed. The redress of education in rural areas requires integrated planning and implementation with the participation of local government and communities (DoE, 2005). The role of all stakeholders needs to be researched.

In South Africa, we need more research about the principal's role in implementing ICT in the classroom. It is not enough to just allow technology in schools. Principals need to play an effective role in the management of the technology, ensuring that training takes place, going for training themselves, and ensuring that the technology is utilised by the teachers. Without a thorough understanding of computer technology's capabilities, principals will not be ready to provide the leadership in technology necessary for the restructuring of schools. There are a few studies focussing on leadership for technology reform in schools (Brockmeier, et al., 2005, Yee, 2006). Research on how the vision and mission of schools relates to principals, SGBs and ICT is also needed. Principals need to work with SGBs to explore the

vision and mission of the school and how it relates to ICT. Managers decide how to use the organisation's resources and their decisions directly impact on the socio-economic situation of a society. Principals need to adjudicate between competing priorities and determine how to resource new initiatives.

In this project, traditional and matrix organisational reporting lines exist next to each other. Differences and similarities between bureaucratic and organic organisations should be investigated further, and how to bring about a shift in thinking, where concepts like control, order, power and hierarchy must be replaced by trust, mutual respect, and acceptance of the on-going process of organisational educational change.

I concentrated on the management challenges in this rural network, but there are many more research opportunities, for example the positive changes noticed, like the training opportunities, teacher's and learner's use of technology, the improvement in the results and obtaining of bursaries over the years, the teacher's and learner's motivation, the influence of the teachers doing the transmissions on the rural learners, decreased workload for the rural teachers, the influence of the quarterly meetings and yearly plan, professional development of teachers and different teaching methods used in the network.

Solutions can be investigated for the challenges noted, like financing, increased workload due to more assessments, the organisational challenges of the project versus the Department, lack of technology resources like insufficient computers, external challenges like transport, resources challenges like upgrades or not enough classrooms, subject restrictions which exclude subjects other than Maths and Science, time challenges like re-teaching learners, time table challenges to fit the project into all the schools' timetables.

Learners and teachers can be observed while they are using the IWB network, for example, in the October holiday school, and then interviewed. Different learning styles can be identified and the influence of the use of the technology on learners with different learning styles investigated. The participation of different schools can be compared.

A historical study can be done and the changes from 2008 until present can be investigated. Lessons learnt in this project can also be applied to the new networks started in Mpumalanga.

In my study, I only used description as a tool. Explaining can be done of findings or why such a model developed, why the influence of SGBs is very limited or why the realities of the respective role players present themselves in a particular way.

#### **5.4 Conclusion**

The purpose of my research was to determine the key managerial challenges in implementing an ICT network at a cluster of schools and the possible management model that may be used in managing an ICT network incorporating numerous schools. I also wanted to understand the type of management approach that developed during the implementation of the network and determine what critical incidents occurred during the life span of the project that had an effect on the management of the project, as well as the possible contribution that lessons learnt from this case study could have on management theory regarding the management of ICT in similar multi-school models.

The key managerial challenges were divided into the rural and leading schools' challenges. Principals', teachers' and resources challenges were the primary focus for the rural schools. The challenges for the leading school encompassed the difficulties reported by rural schools, as well as the goals and challenges in the management of the project. A matrix model was identified as a possible management model that may be used in managing an ICT network involving numerous schools. It was later concluded that a matrix model evolved only in the leading school. A systems approach was identified in the network, where the subsystems, namely budgeting, planning, organising, leading, controlling, motivating, staffing, co-ordinating are the key managerial functions, with communicating linking the different subsystems.

It can be concluded that critical incidents may be regarded as positive as well as challenging. The different role players have a positive influence on the project, as well as the received resources and administrative functions like the establishment of the e-learning office. Human challenges were divided into emotional challenges and

learners' and teachers' challenges. Non-human challenges are organisational challenges, external challenges and financial challenges.

The possible contribution that lessons learnt from this case study could have towards management theory with respect to the management of ICT in similar multi-school models is discussed earlier in this chapter.

The whole project's biggest asset is also its greatest threat. The project is built around the project manager taking initiative in developing it and keeping it going. If the project should lose this pivot around which it revolves, it runs the risk of dying a slow death. There is no succession planning. Capacity in terms of management is not developed and nurtured, thus making the project leader a maverick.

This Mpumalanga project is worthy of more research endeavours, and novel research possibilities exist in the expansion of the project to other regions.

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## Appendices

### Appendix A: Permission letters

#### 1.1 Letter to the Mpumalanga Department of Education



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of Education  
Department of Education Management and  
Policy Studies  
03 May 2013

The Head of Department  
Mpumalanga Department of Education  
Private Bag X 11341  
Nelspruit  
1200

Dear Mrs. Mhlabane,

#### Permission to undertake research in Ermelo schools

I wish to ask permission to undertake research in Ermelo for my PhD in Education Management and Policy Studies at the University of Pretoria.

As you may know, a school in Mpumalanga developed an ICT learning network that link their own school with schools in disadvantaged areas. The main purpose was to reach out to rural schools in the area in order to improve the teaching of Science and Mathematics for grade 12 learners. As a concept it is unique to schools in South Africa. Realising the potential that such an initiative has in addressing the needs of disadvantaged schools the University of Pretoria became interested in conducting research on the initiative. One of the risk factors identified in the initial research conducted by the University in 2008 was the management of the network. Since 2008, a lot of further development took place and the overall aim of my proposed study is to investigate the management challenges of an ICT network in six rural schools. This research will be of significance not only to the schools participating in the network, but to all schools interested in developing a similar project and would therefore also be of benefit to the Mpumalanga Department of Education.

The research will imply the following:

1. One-to-one semi-structured interviews (approximately 30 minutes) will be conducted with a) the project organiser, b) the principal of each school, c) a SGB member of each school, d) two HOD's of each school, e) the project leader(s) of each school, f) two teachers of each school, on a voluntary basis, at a time and venue convenient for the participants.
2. Document analysis will be done through analysis of, for example, reports on the project, minutes of meetings, newspaper articles and journals.

Due to the uniqueness of the project, complete anonymity cannot be guaranteed. To protect the interest of all participants in the research, the draft report based on the data collected will be made

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available and discussed with the participants to ensure that sufficient safeguards are built into the project to protect the identity of participating schools and participants. In an effort to protect the identity of participants, no names of schools or participants will be mentioned in the report and schools will be referred to as School A, B or C and educator A, B and C. Informed consent will be obtained from all participating educators, school principals, HODs and other role-players and they will be informed that they may withdraw from the project at any stage without any negative consequences. All interviews will take place at a time and place convenient to participants and no interviews will interrupt the educational activities of the participants.

If you have any more queries about this research, please feel free to contact me or my supervisor, Prof. F. J. Nieuwenhuis at (012) 4202842 (o) or 0827887637 or email him at [jan.nieuwenhuis@up.ac.za](mailto:jan.nieuwenhuis@up.ac.za)

**Yours faithfully**



**PhD Candidate and Researcher - Maryke Mihai (cell: 0824302928)**



**Research Supervisor - Prof. F. J. Nieuwenhuis (cell: 0827887637)**

## 1.2 Permission from the MDoE

 <p><b>education</b> DEPARTMENT: EDUCATION MPUMALANGA PROVINCE</p>	<p>Private Bag X 11341 Nelspruit 1200 Government Boulevard Riverside Park Building 5 Mpumalanga Province Republic of South Africa</p>
<p><i>Litiko leFemfundvo    Umyango weFundo    Departement van Onderwys    Umyango weselfundo</i> <i>Enquiries: A.H Baloyi (013) 766 5476</i></p>	
<p><b>MARYKE MIHAI</b> <b>UNIVERSITY OF PRETORIA</b> <b>GROENKLOOF CAMPUS</b> <b>0002</b> <b>RSA</b></p>	
<p><b><u>RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH FOR PhD DEGREE.</u></b></p>	
<p>Your application (dated April 2013) to conduct research in the Province was received on the 15 May 2013. The title of your study reads: <del>Managerial challenges to principals when faced with accepting, introducing and managing new technology in the schools.</del></p>	
<p>Your request is approved subject to you observing the content of the departmental research manual which is attached. You are also requested to adhere to your University's ethics as spelt out in your research ethics document.</p>	
<p>In terms of the attached manual (2.2. bullet number 4 &amp; 6) data or any research activity can only be conducted after school hours as per appointment. You are also requested to share your findings with the relevant sections of the department so that we may consider implementing your findings if that will be in the best interest of department.</p>	
<p>For more information kindly liaise with the department's research unit @ 013 766 5476 or <a href="mailto:a.baloyi@education.mpu.gov.za">a.baloyi@education.mpu.gov.za</a>.</p>	

Sisonke Sifundzisa Sive

  
MPUMALANGA  
A Pioneering Spirit



APPLICATION TO CONDUCT RESEARCH FOR MARYKE MIHAI: REQUEST FOR YOUR APPROVAL

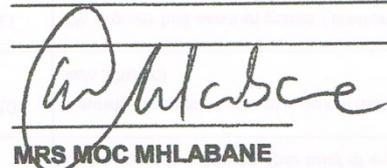
The department wishes you well in this important project and pledges to give you the necessary support you may need.

**APPROVED/NOTAPPROVED:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



**MRS MOC MHLABANE**  
**HEAD OF DEPARTMENT**

03.7.13  
**DATE**

Sisonke Sifundzisa Sive



### 1.3 Letter addressed to the principals



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of Education  
Department of Education Management and  
Policy Studies  
2 May 2013

Dear Sir,

#### Management challenges of an ICT network in rural schools

I am a PhD student enrolled at the University of Pretoria and I hereby would like to take this opportunity to ask for permission to conduct research at your school.

As you are aware, a school in Mpumalanga developed an ICT learning network in 2008 that link their own school with schools in disadvantaged areas. The main purpose was to reach out to rural schools in the area in order to improve the teaching of Science and Mathematics for grade 12 learners. As a concept it is unique to schools in South Africa. Realising the potential that such an initiative has in addressing the needs of disadvantaged schools the University of Pretoria became interested in conducting research on the initiative. One of the risk factors identified in the initial research conducted by the University in 2008 was the management of the network. Since 2008 a lot of further developments took place and the overall aim of my study is to investigate the management challenges of an ICT network in six rural schools. This research will be of significance not only to the schools participating in the network, but to all schools interested in developing a similar project.

The research will imply the following:

1. The one-to-one semi-structured interviews (approximately 30 minutes) that will be conducted with a) yourself, b) a SGB member, c) two HODs d) the project leader(s) e) two teachers teaching through the network on a voluntary basis, at a time and venue convenient for the participants.
2. Document analysis will be done through analysis of, for example, reports on the project, minutes of meetings, newspaper articles and journals.

This research is subjected to all ethical research requirements of the University of Pretoria in terms of confidentiality, anonymity, no betrayal, no deception, privacy, and informed consent. Since the ICT network developed is one of a kind in Mpumalanga, complete anonymity cannot be guaranteed. To protect the interest of all participants in the research, the draft report based on the data collected will be made available and discussed with the participants to ensure that sufficient safeguards have been built into the project to protect the identity of participating schools and participants. In an effort to protect the identity of participants, no names of schools or participants will be mentioned in the report and schools will be referred to as School A, B or C and educator A, B and C. Informed consent will

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Republic of South Africa

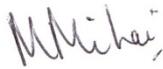
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C. Informed consent will be obtained from all participating school principals, educators, HOD's and other role-players and they will be informed that they may withdraw from the project at any stage without any negative consequences.

If you have any queries about this research, please feel free to contact me or my supervisor, Prof. F.J. Nieuwenhuis at (012) 4202842 (o) or 0827887637 or email him at [jan.nieuwenhuis@up.ac.za](mailto:jan.nieuwenhuis@up.ac.za)

**Yours faithfully**



**PhD Candidate and Researcher – Maryke Mihai - (cell: 082 4302928)**



**Research Supervisor - Prof. F.J. Nieuwenhuis (0827889637))**

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## 1.4 Letter to participants



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of Education  
Department of Education Management and  
Policy Studies  
3 May 2013

### **Letter of Informed Consent for participation in the study investigating: Management challenges of an ICT network in rural schools**

Dear Participant,

In 2008 a school in Mpumalanga developed an ICT learning network that link their own school with schools in disadvantaged areas. The main purpose was to reach out to rural schools in the area in order to improve the teaching of Science and Mathematics for grade 12 learners. As a concept it is unique to schools in South Africa. Realising the potential that such an initiative has in addressing the needs of disadvantaged schools the University of Pretoria became interested in conducting research on the initiative. One of the risk factors identified in the initial research conducted by the University is the management of the network. The overall aim of this research is to investigate the management challenges of an ICT network in six rural schools. This research will be of significance not only to the schools participating in the network, but to all schools interested in developing a similar project.

Should you choose to participate in this research; the following research activities will be required of you:

Participation in a one-to-one conversational semi-structured interview lasting approximately 30 minutes in which your ideas about the management challenges at your school when a ICT network with other schools was introduced for the teaching of Mathematics and Science.

A follow-up discussion to verify the accuracy of my analysis and to allow you to make further inputs and comments.

Ethical procedures will be followed in that the interviews will be conducted in private, on a one-on-one basis at a location indicated by the research participant.

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All ethical protocols will be observed. The interviews will be conducted in an informal manner and you will be given the interview schedule in advance to prepare for the interview. Any documentation that would assist me in understanding the management challenges better will be appreciated and will be treated as confidential. I will conduct the interviews and record them electronically which will later be transcribed and analysed. Your consent to audio-tape the interview will be appreciated. It is important to note that your name and identities of offices and institutions will be withheld in the reporting of the data. No information that you share will be disclosed to other individuals in a way that will allow them to identify contributions that you may make to the research. Even if you agree to participate in the research your right to withdraw from the research at any stage will be honoured without any negative consequences.

As such, confidentiality will be guaranteed. Due to the uniqueness of the project, complete anonymity cannot be guaranteed. To protect the interest of all participants in the research, the draft report based on the data collected will be made available and discussed with you to ensure that sufficient safeguards have been built into the project to protect the identity of participating schools and participants. In an effort to protect the identity of participants, no names of schools or participants will be mentioned in the report and schools will be referred to as School A, B or C and educator A, B and C. Informed consent will be obtained from all participating educators, school principals, HOD's and other role-players.

The research results, in the form of a thesis will be used to meet the requirements for a Doctoral Degree in Education Management, Department of Education Management and Policy Studies at the Faculty of Education, University of Pretoria. The thesis will become public domain for the scrutiny of examiners and the academic community. The findings may as such be used for publication in academic articles and for presentation at academic conferences.

If you are willing to participate in this research, please sign below in the space provided by this letter as a declaration of your consent i.e. that you participate willingly and that you understand that you may withdraw from the study at any time.

Participant's Signature: \_\_\_\_\_

Researcher's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

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[www.up.ac.za/education](http://www.up.ac.za/education)

Furthermore, to collect research data it is sometimes necessary to use a voice recorder, or dicta phone so that no important information that you may share is lost before it can be captured and analysed.

If you consent to electronic recording of the interview please sign below:

Participant's Signature:

Researcher's Signature:

Date: \_\_\_\_\_

Should you have any queries about the research and / or the contents of this letter, please do not hesitate to contact me or my supervisor for further information.

Yours faithfully



Phd Candidate and Researcher – Maryke Mihai - (Cell: 0824302928) (012) 4202077 (o)



Research Supervisor - Prof. F.J. Nieuwenhuis (Cell: 0827889637) (012) 420-2842 (o)

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## Appendix B: Interview schedule

### 1. Interview schedule for principals

- 1 What would you regard as the biggest contribution of the ICT project in terms of your own school?
- 2 How do you generally manage the ICT project in your school?
- 3 What do you regard as your school's greatest need in terms of ICT?
- 4 The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion among staff? If so, how did you deal with it?
- 5 Are the management roles of the project leader, project organiser, educators and other role players clearly defined?
- 6 What process did you follow to define the roles of the various role players in the management of the project?
- 7 To what extent do you expect educators and role players in the project to manage themselves - in other words, to set up their own goals and work schedules without having to be constantly supervised?
- 8 How do you ensure that the priorities of the school in terms of its mission and vision are aligned to the priorities of the ICT project?
- 9 Matrix management systems are often vulnerable to constant changes. What are some of the changes in the system that you had to deal with?
- 10 Did the changes that occurred result in the disruption of the relations between schools and the role players in the cluster?
- 11 What opportunities for professional growth and development were created in the ICT project?
- 12 Did you notice any effect that the ICT project may have had on the motivation of
  - a) teachers
  - b) learners
- 13 What other teaching benefits did you notice?
- 14 From your experience, did the project increase the workload of the educators involved? Elaborate.
- 15 What are frequently mentioned problems by the teachers?
- 16 Who is responsible for monitoring the performance of educators involved in the project?
- 17 What are some of the key managerial challenges you faced in implementing this project at your school?
- 18 If you think of the different role players in the project, how would you describe their influence on the project?
- 19 What is the role of the SGB in terms of the project?
- 20 If you had to give advice to other schools who want to start a similar project, what would it be?

## 2. Interview schedule for the general organiser

- 1 Please describe briefly the origin and conceptualisation of the ICT project.
- 2 Please describe briefly the training offered to various role players in the ICT project.
- 3 What would you regard as the biggest contribution of the ICT project in terms of the schools involved?
- 4 What do you regard as schools' greatest need in terms of ICT?
- 5 The ICT model implemented in the cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion among staff? If so, how did you deal with it?
- 6 Are the management roles of the project leader, project organiser, educators and other role players clearly defined?
- 7 To what extent do you expect educators and role players in the project to manage themselves - in other words, to set up their own goals and work schedules without having to be constantly supervised?
- 8 Matrix management systems are often vulnerable to constant changes. What are some of the changes in the system that you had to deal with?
- 9 Did the changes that occurred result in the disruption of the relations between schools and the role players in the cluster?
- 10 What opportunities for professional growth and development were created in the ICT project?
- 11 Did you notice any effect that the ICT project may have had on the motivation of
  - c) teachers
  - d) learners
- 12 What other teaching benefits did you notice?
- 13 From your experience, did the project increase the workload of the educators involved? Elaborate.
- 14 What are frequently mentioned problems by the teachers?
- 15 Who is responsible for monitoring the performance of educators involved in the project?
- 16 If you think of the different role players in the project, how would you describe their influence on the project?
- 17 If you had to give advice to other schools who want to start a similar project, what would it be?
- 18 How do you see the future of this project?

### 3. Interview schedule for SGB members

- 1 As a representative of the school, how would you describe the contribution that the ICT project made in the school?
- 2 What were some of the issues on which you had to take a decision regarding the ICT project?
- 3 How did those decisions positively or negatively affect the project?
- 4 What do you regard as the school's greatest need in terms of ICT?
- 5 Looking at the project from the outside, what would you regard as some of the key managerial challenges during the implementation of this project?
- 6 The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion among staff? If so, how did you deal with it?
- 7 Matrix management systems are often vulnerable to constant changes. What are some of the changes in the system that you as an SGB had to deal with?
- 8 Did the changes that occurred result in the disruption of the relations between schools and the role players in the cluster?
- 9 Did you notice any effect that the ICT project may have had on the motivation of
  - a) teachers
  - b) learners
- 10 What other teaching benefits did you notice?
- 11 From your experience did the project increase the workload of the educators involved? Elaborate.
- 12 What are frequently mentioned problems of those involved in the ICT project?
- 13 If you had to give advice to other schools who want to start a similar project, what would it be?
- 14 How do you see the future of this project?

#### 4. Interview schedule for the HODs

- 1 What would you regard as the biggest contribution of the ICT project in terms of your own school?
- 2 How do you generally manage the ICT project in your department?
- 3 What do you regard as your school's greatest need in terms of ICT?
- 4 The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion among staff? If so, how did you deal with it?
- 5 Is your management role in terms of the ICT project clearly defined?
- 6 What process was followed to define your role in the management of the project?
- 7 To what extent do you expect educators in the project to manage themselves - in other words, to set up their own goals and work schedules without having to be constantly supervised?
- 8 Matrix management systems are often vulnerable to constant changes. What are some of the changes in the system that you had to deal with?
- 9 Did the changes that occurred result in the disruption of the relations between schools and the role players in the cluster?
- 10 What opportunities for professional growth and development were created in the ICT project?
- 11 Did you notice any effect that the ICT project may have had on the motivation of
  - a) teachers
  - b) learners
- 12 What other teaching benefits did you notice?
- 13 From your experience did the project increase the workload of the educators involved? Elaborate.
- 14 What are frequently mentioned problems by the teachers?
- 15 Who is responsible for monitoring the performance of educators involved in the project?
- 16 What are some of the key managerial challenges you faced in implementing this project at your school?
- 17 If you think of the different role players in the project, how would you describe their influence on the project?
- 18 If you had to give advice to other schools who want to start a similar project, what would it be?

## 5. Interview schedule for project leaders

- 1 What would you regard as the biggest contribution of the ICT project in terms of your own school?
- 2 How do you generally manage the ICT project in your school?
- 3 What do you regard as your school's greatest need in terms of ICT?
- 4 The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion for you as project leader? If so, how did you deal with it?
- 5 Is your management role clearly defined?
- 6 What process was followed to define your role in the project?
- 7 To what extent do you expect educators in the project to manage themselves - in other words, to set up their own goals and work schedules without having to constantly be supervised?
- 8 Matrix management systems are often vulnerable to constant changes. What are some of the changes in the system that you had to deal with?
- 9 Did the changes that occurred result in the disruption of the relations between your school and the other role players in the cluster?
- 10 What opportunities for professional growth and development were created in the ICT project?
- 11 Did you notice any effect that the ICT project may have had on the motivation of
  - a) teachers
  - b) learners
- 12 What other teaching benefits did you notice?
- 13 From your experience did the project increase the workload of the educators involved? Elaborate.
- 14 What are frequently mentioned problems by the teachers?
- 15 Who is responsible for monitoring the performance of educators involved in the project?
- 16 What are some of the key challenges you face in implementing this project at your school?
- 17 If you think of the different role players in the project, how would you describe their influence on the project?
- 18 If you had to give advice to other schools who want to start a similar project, what would it be?

## 6. Interview schedule for teachers

- 1 Did the training that you have received on ICT adequately prepare you for your role?
- 2 What were some of the initial challenges that you had to face?
- 3 What would you regard as the biggest contribution of the ICT project in terms of your own school?
- 4 What do you regard as your school's greatest need in terms of ICT?
- 5 The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion for you?
- 6 Is your role in the project clearly defined?
- 7 To what extent do you have to manage yourself - in other words, to set up your own goals and work schedules without having to be constantly supervised?
- 8 Matrix management systems are often vulnerable to constant changes. What are some of the changes in the system that you had to deal with?
- 9 Did the management changes result in the disruption of the relations between you and other role players in the cluster?
- 10 What opportunities for professional growth and development were created in the ICT project?
- 11 Did you notice any effect that the ICT project may have had on the motivation of learners?
- 12 What other teaching benefits did you notice?
- 13 From your experience, did the project increase your workload? Elaborate.
- 14 What are some of the problems that you encountered with the ICT project?
- 15 Who is responsible for monitoring your performance?
- 16 If you think of the different role players in the project, how would you describe their influence on the project?
- 17 If you had to give advice to other schools who want to start a similar project, what would it be?

## 7. Interview schedule of the Representative of the MDoE

- 1 Please describe briefly the origin and conceptualisation of the ICT network.
- 2 Please describe briefly the training offered to various role players in the ICT network.
- 3 What would you regard as the biggest contribution of the ICT project in terms of the schools involved?
- 4 What do you regard as schools' greatest need in terms of ICT?
- 5 The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion among staff? If so, elaborate.
- 6 Were the management roles of the principals, project leaders, project organiser, HODs, educators and other role players clearly defined?
- 7 To what extent do you expect educators and role players in the project to manage themselves - in other words, to set up their own goals and work schedules without having to be constantly supervised?
- 8 Matrix management systems are often vulnerable to constant changes. Did you see a matrix management system develop at the schools? If not, what other management system(s) evolved?
- 9 Did the changes that occurred result in the disruption of the relations between schools and the role players in the cluster?
- 10 What opportunities for professional growth and development were created in the ICT project?
- 11 Did you notice any effect that the ICT project may have had on the motivation of
  - a) teachers
  - b) learners
- 12 What other teaching benefits did you notice?
- 13 From your experience did the project increase the workload of the educators involved? Elaborate.
- 14 What are frequently mentioned problems by the teachers?
- 15 Who is responsible for monitoring the performance of educators involved in the project?
- 16 Did the SGBs play a significant role? Elaborate.
- 17 If you think of the other different role players in the project, how would you describe their influence on the project?
- 18 If you had to give advice to other schools who want to start a similar project, what would it be?
- 19 How do you see the future of this project?
- 20 What else can you add to shed light on the management of this network?

## Appendix C: Constant comparison of interviews on the management of the project

**Table 1: Interviews with principals**

	Principal 1	Principal 2	Principal 3	Principal 4	Principal 5	Principal 6
How do you manage the network in your school?	Programme has been drawn up by LS, they just have to fit it in time schedules.	They set up a structure and keep people permanently in posts.	They formed a committee to run the project, led by co-ordinator.	Principal had big part in initiating stages, now HOD of Maths Lit. has leading role.	Principal had specific educators responsible for key subjects trained.	Their project leader is coordinating project locally, and PM of LS.
Did multiple reporting lines cause any stress, confusion or conflict?	No, discuss and report everything at cluster level.	No. People do not focus on themselves, they work together for success of project.	Some kind of confusion between district and project, they managed to match the two.	No. Leadership of LS very clear and open. Knows 3 months in advance about meetings.	No confusion, staff is fully aware of how program operates, to report to others may cause stress.	Timetable complicated, they have 17 learning areas in a grade.
How do multiple reporting lines work in your school?	No project leader, teachers report to principal vertically and to PM at LS horizontally.	Matrix system-committee lead project, lines horizontally to PM, AO, vertically to principal.	No multiple reporting. Coordinator-gadgets, HODs-academic, teachers-subjects, LS-cluster.	No multiple reporting. Only one person. She reports to principal vertically and LS horizontally.	No project leader, just HODs and teachers, reporting to the principal vertically and LS horizontally.	Principal (vertically) together with program leaders in LS (horizontally) define roles.
To what extent do the role players manage themselves?	Managing themselves at own school.	Have to develop and take responsibility for own duties.	They recruited good teachers who are willing to work, self-starters.	HOD manages herself, project roped in all teachers in cluster.	Principal expects from them to work at own pace and consult LS with problems.	The program is pushing teachers; pacesetters for rest of staff.
Are priorities in terms of mission and vision aligned with the ICT network?	Supporting mission and vision. Want to provide quality education.	Mission is to lead people to God, and to become valuable citizens in country.	Logo is: Hard work brings success. ICT project cultivate love for learning, competent learners in 21 <sup>st</sup> century.	Highest priority: quality of education, project increases quality of teaching and learning.	Mission: effective teaching and learning, project ensures learning is according to expected standards.	The schools' vision is aligned with issues of ICT; teachers should be able to compete with outsiders.
How would you describe influence of	PM has a great influence on it. Other	Everybody has clear lines of duty and	Emphasises the role of the sponsors,	Attended a few meetings-principals	Project has influence-teachers do not want to	Positive part from private sector, relating to

different role players?	people's ideas are not incorporated.	has a positive influence, from PM, AO, HODs and teachers.	positive attitude, and LS who recruited them.	very positive about project.	teach in classes where there are no e-learning facilities.	school, good Samaritans, hearts in human investment.
What is the influence of the SGB?	Money, security, insurance.	Chair and daily committee, vision of change, willing to put in money.	Governors of school, financial, safeguard gadgets, monitors the school.	Proud of fact that school is involved, chairperson very happy.	Supporting school, assist with funds, cover insurance.	Governance needed. Security, asset management educates public.

**Table 2: Interviews with teachers**

	<b>School 1: Tea 1</b>	<b>School 1: Tea 2</b>	<b>School 2: Tea 1</b>	<b>School 3: Tea 1</b>
Whom are you reporting to? Who is responsible for monitoring your performance? (Q1)	The immediate person he reports to is his principal. Reports to HOD of FET. They also report results to the LS.	Report technical difficulties to someone at the LS, and to another one admin difficulties. At the end of the term the AO is asking for the marks. In own school to nobody.	No reporting. She is responsible for putting planning of subject on system. Everybody, PM and AO and teachers just have to play their roles.	His immediate supervisor is the HOD and the principal and he has to report their progress to the LS.
Did multiple reporting lines cause any stress, confusion or conflict? (Q2)	No.	No.	Not at all. Meeting at beginning of year, plan topics for whole year with teachers in cluster.	No. What the LS does, must align with the Department.
Is your role in the project clearly defined? (Q3)	Yes, he is an e-learning educator. Must prepare notes. He communicates with the technician to ensure transmission takes place. In charge of microphone during transmissions.	She is just sitting in the transmissions and maintains order in her class while the transmission is going on.	Yes, everybody's role is clearly defined- PM, AO and teachers.	Yes, he needs to ensure that he opens the computers for the learners in time for the transmissions and has to prepare reports for the learners.
To what extent do you have to manage yourself? (Q4)	He can work with little or no supervision. Teach Maths as major and Science as minor.	In e-learning she is managing herself. There is no project leader. The principal is not really involved.	You set goals to obtain a 100% pass rate. Communication between everybody. Maths, Science and Maths Lit teachers are all on their own, as well as AO, PM.	Not to a great extreme. Most of the things are already prescribed- work schedules from Department and LS, HOD is also setting goals.
How would you describe the influence of	Sometimes a coordinator or technician does	The AO only collects the marks and does	Everybody's is role important. If everybody is not	Sponsors have a great influence, they want to see

different role players? (Q5)	not approach you, you cannot rule out the issue of the human being.	not really understand what is going on in class. Technical staff is really helpful, the PM is sometimes very hard to reach.	playing their part, there will not be a project.	where they are putting their money, the LS is monitoring to see if they use the equipment, The DoE also interested.
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**Table 2: Interviews with teachers (continued)**

	<b>School 5: Teacher 1</b>	<b>School 5: Teacher 2</b>	<b>School 5: Teacher 3</b>	<b>School 6: Teacher 1</b>	<b>School 6: Teacher 2</b>
Q1	He normally reports to his HOD and she monitors him.	She is reporting results to the LS and to own school- HOD monitors her performance.	To the HOD and deputy principal.	On e-learning to the PM and AO in the LS, they submit the marks, in own school to principal.	In the ICT network it is the LS, they want to see the marks and the HOD internally.
Q2	No. It just produces more work in terms of marking and compiling results.	No. Normally their pace setter is in line- they sit down with teachers of the same subject in clusters.	No. With work schedule you know what to do. Must teach class according to schedule.	No, it is direct communication, meetings, they sit down and agree what to do, communicate urgent issues via network.	No, it was to their advantage, all the schools have the same problems and challenges.
Q3	He is just a teacher, looking after learners when there is a live broadcast, he fully understands his role.	Yes, she thinks so.	Yes, he has to communicate to structure in LS and pay attention to the teacher broadcasting.	Yes. There is a two way communication, they have lessons per week for Maths, Science, Maths Lit, and interact with other schools.	Yes. He knows exactly what to do.
Q4	Generally he is working independently, with minimal supervision, he knows what he wants to achieve.	She has not been supervised, but they couch one another and set common tests. Just working together.	He sets his own goals, like working on schedule, his goals are achieved, and learners participate.	Almost every time, he sets up his own classroom, objectives, as individual he sets own goals.	He has the work schedule of the Department and the e-learning programme, and ensures that everything works.
Q5	Project depends on everybody playing their roles effectively, technicians, managers and teachers.	Influence very positive from LS- technicians fix things, and teachers doing broadcasting.	Sponsors provide them with paper, learners are learning and teachers are teaching.	The LS is the initiators, without sponsors there will be no project, the school for allowing project.	The ones from LS are teaching, technicians handle problems, they do repairs.

**Table 3: Interviews with HODs**

	<b>School 2: HOD1</b>	<b>School 2: HOD2</b>	<b>School 3: HOD1</b>	<b>School 3: HOD2</b>	<b>School 4: HOD1</b>	<b>School 6: HOD1</b>
How do you manage the ICT network in your department?	It is very simple, because she is the only one in her department responsible for the project, she is doing the transmissions.	It is just her, so it is very simple, they have a lesson once a week, she does not have a class in front of her.	During transmission days educators involved go to the computer centre, they log in for transmissions and keep computers safe.	They put aside enough time for the lessons transmitted from LS, so that there is no clash of periods, it is working well.	They have a yearly plan saying exactly when they have lessons, so their timetable is set according to that.	The ICT network is managed like any other learning area; she checks the results and analysis from the teachers.
Did multiple reporting lines cause any stress, confusion or conflict?	Teachers never had anything to argue about; they respect and help each other.	Not stress, but they have to give in marks, schools are far and the LS has to send a worker to collect it.	No, it did not cause anything. They are getting more knowledge.	No, it has caused no confusion, instead everybody is excited about it, they have results from the project.	No, because they know that they need certain results for the meetings, they know what is expected.	No, there was no conflict or stress; it is the same that they report on each and every subject.
To whom are the teachers reporting?	To HOD in their cluster meetings, and to AO for marks or problems- she is main centre, then HOD and AO have a meeting.	The results go to the AO, the actual lesson is the responsibility of the HOD.	The marks are going to the coordinator, the HOD is moderating, and she is managing the department of Science, Life Science and Maths.	They have various bodies of people to report to- bring the problems of their school together with the LS, it becomes a single problem to work on.	She is the only teacher working on the project in her school. She is reporting marks to the LS, teachers from other schools report to her in a cluster.	One more reporting line was added than the usual. They have to report to the LS everything they need; they go for moderation in cluster.
Is your management role in terms of ICT clearly defined?	She has to work out her lesson on the white board, the tests and planning is done very well, she knows what is expected of her.	Yes, she is Maths and everything about Maths is her task. The PM asked her if she can manage to do the lessons.	Yes, educator marks the tests, she is moderating it, they analyse the problems, and they come together with other schools and help each other.	Yes, he knows exactly what he must do- no role has encroached into the other.	Yes, she has to log in for transmissions, her class must be prepared, topics and notes are communicated, sometimes she is teaching a lesson.	No, the roles were not defined. The teachers are mostly involved. She is just making sure that they get it if there is a need for something.
To what extent do you expect the	The teachers in the schools where she is teaching are	They must know that they are responsible at the end,	The goal is that the educators come together in a	It is very important, because they need to teach the	She is managing herself and is driven by her own	Project has its own program, sometimes not the

educators in this network to manage themselves?	very good, proud of their work. They are listening to her and are motivated to do things in another way.	the results are their results, and they see this as an opportunity to help them.	in a subject team, they assist each other and share through class visits.	topics before they are transmitted, it makes it easier for learners to follow.	goals.	same than work schedule from DoE. If there are loopholes, teachers need to give extra classes.
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**Table 4: Interviews with SGBs**

	<b>School 1: SGB 1</b>	<b>School 2: SGB</b>	<b>School 3: SGB</b>	<b>School 4: SGB</b>	<b>School 5: SGB</b>	<b>School 6: SGB</b>
What would you regard as the key managerial challenges during the implementation of the project?	I wanted to interview the SGB member the principal send me to, but he did not know anything about the project.	The PM indicated that the SGB does not play a huge role- they give the green light and wants feedback on the project.	It is important to take decisions as the government of the school- in the next five years they want to change everything in the right manner.	He cannot remember when the project started, but they showed them when they are busy teaching and the kids are very glad getting knowledge from outside.	It becomes a scary thing, but once you are in it, then it gives you those challenges, and that motivation to work on it to gain more experience.	They have to make some things that can bring some money so that they can manage this project, like fundraising.
Did multiple reporting lines cause stress, confusion or conflict?			No, not at all. It is very important to be informed about the project, it opened our minds.	I cannot say that it caused conflict or stress, because when you are there you can see they are doing it with a smile.	At first it was confusing, because people did not know how it is going to work, but once they got into it they seen the advantage of it.	Sometimes confusion because teachers who want to use this Internet they find someone else is using it.
What are some of the changes that you as a SGB had to deal with?			Every step you need to take as a school must be to learn, it is important that we must report it to one another.	He can say safety first for the teachers and the kids; they have to take care of those things in the school. He thinks they need more classes in the school.	When you focus on one thing or person, it is a challenge of working with different people and then seeing what they are actually doing.	Sometimes we have a problem, we report it to the principal, he meets with the SGB, and they try to fix the problem.

**Table 5: Interviews with project manager / organiser**

	<b>School 2: Project manager</b>	<b>School 4: Project organiser</b>
How do you generally manage the ICT network in your own school?	They have an e-learning office, where they have the PM, an AO, who has to administer everything, an IT administrator, knowledgeable in the computers themselves and the network, and the technicians, putting a new computer or smart board in.	On a day-to-day basis, they are faced with some challenges being rural, for example power supply, but being in partnership with the LS, they support them and send out maintenance people regularly to keep the system going. His role is that of an area reporting person.
Did multiple reporting lines cause any stress, confusion or conflict?	There was no conflict, because the rural schools can see the impact of the project and the benefits, he does not think stress, although teachers may think that they are checked up by LS, and must do their work better than before, no confusion, because they have meetings every term.	No stress or complications, because they are so close to the LS and they always communicate ideas and processes to them upfront, and there is always time for discussion. About the content that is a subject head or teacher environment, there will always be some stresses, but on the ICTs side they can pick up the phone day or night to contact the LS.
What are some of the changes that you had to deal with in the matrix management system that evolved?	In the beginning everybody came to him to report back and he had to report to the principal and SGB. Now, with the project team, everyone reports to them and just the final report from the AO comes to the PM, so it is working very well now.	He firstly reports to his head master, in terms of the content side, but he is also very close to the LS, in terms of the IT side he reports directly to the PM. He does not report to the HOD or district office.
Is your management role clearly defined?	The management team in the office knows exactly what to do, the PM sets his own role, his role is to go out and get sponsors to keep the project going and give them feedback.	Yes, it is based ability and a bit of history in terms of exposure to this environment, so he knows exactly what he is supposed to be doing. He sees himself as a kind of forerunner of every lesson, making sure that the systems are up and running and everything is communicated properly.
To what extent do you expect the educators in this network to manage themselves?	The teachers in the rural and township schools have their own management system. The principal tells them how to manage their classes. The project is just there to help them to stick to the same pace setter that they need for the Department, the LS give them specialised notes and training to stay on track.	He thinks it is critical, more so because the lessons are presented to multiple players, and it is important that those lessons are prepared properly, that the communication is clear, because it is a learning opportunity for the people out there that are involved in the transmissions.
What is the role of the SGB in the project management?	In the beginning it was about their role in the community and they played a more active role than now. Now are not very involved in the project itself, but still give the green light and they are paying two staff members, so they want feedback.	The SGB has bought into the concept. They sit as a team. There is a chair person, representatives of their parents, and representatives on behalf of the school, like himself, and all aspects of schooling are covered around the table. Once the school is for a project, the SGB and community buy into it, and every step is monitored, debated and approved or disapproved.
If you think of the different role players in this network, how would you describe their	The AO plays a huge role in this, she must on a daily basis talk to the people, and ensures that the reports are back in, make sure problems get to the IT specialist,	They have some very strong role players, firstly it is the PM, then the principal who is supporting and driving the concept, the support of the SGB is behind it, and the Department, right down to the HOD, there

influence in the network?	then they sit around the table and she tells him what she needs.	is nothing negative to report.
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**Table 6: Interview with the administrative officer**

Did multiple reporting lines cause any stress, confusion or conflict?	No, she does not think they have lots of confusion or stress, because everybody is working on the same plan and work schedule, it is a basic schedule working for everybody, the only challenge sometimes is to get reports from the rural schools, that is far from them, but now they get the information by sending one of their workers to get it.
Are the management roles of all the role players clearly defined?	Yes, definitely, everybody knows what they have to do- the teacher at the LS is responsible for the teachers at the other schools, the PM is making the overall decisions about everything, the AO must collect all the documents and ensures that everybody gets their calendars, and the e-learning schools must be up-to-date.
To what extent do you expect the educators and managers in this project to manage themselves?	They have a schedule that they give out in January every year, so the teachers know exactly when everything is scheduled for, then they have a quarterly meeting with all the schools, teachers and HODs, the teachers of the rural schools tell them what topics they are struggling with, then it is their responsibility to log in in the morning, and when something is wrong, they need to let the LS know about it, so they do not need to be checked up every day.
Who is responsible for monitoring the performance of the educators in the network?	The HODs on the side of the LS, and the AO, because she has to check on marks and transmissions, did they log in and print notes.
How would you describe the influence of the different role players on the project?	Everybody has a kind of influence, by taking up their responsibility. If the PM is not there, nobody will know what is their work, if the AO is not there, the paperwork will not be in place, if the LS teachers do not have their lessons ready, the lesson cannot be transmitted, if the teacher in the e-learning school does not log in, the children will not receive that lesson, even if the kids are not there, they cannot give class to anybody, so everybody has an influence to make the project work.

**Table 7: Interview with a representative of the MDoE**

<p>The ICT model implemented in this cluster of schools creates multiple reporting lines for those involved in the project. From your experience, did the multiple reporting lines cause conflict, stress and confusion among staff?</p>	<p>He did not experience conflict or confusion. The quarterly planning meeting for all teachers involved in the project and lead by the leader teachers help to minimise uncertainty and any problems are addressed at that meeting. The principal's forum is also a very important management tool. What lack may be a clear organogram with clear roles and responsibilities and introduction of an Issues Log to report problems. Never skip your principal this can lead to conflict!</p>
<p>Were the management roles of the principals, project leaders, project organiser, HODs, educators and other role players clearly defined?</p>	<p>In the project concept document some of the role-players' roles and responsibilities are defined. The roles and responsibilities of the teachers and the school based project managers are defined in the quarterly meetings.</p>
<p>To what extend do you expect educators and role players in the project to manage themselves?</p>	<p>The success of this project depends squarely on the shoulders of able, willing and motivated teachers. If not, you cannot start such a project. This was one of his concerns from the beginning – one way traffic, receiving schools' teachers sitting back and not participating. He requested the LS leader teachers and project team to ensure that a program of sharing the responsibility and accountability be developed to ensure not only the sustainability of the project but also that knowledge &amp; skills were transferred and mastered. A well-defined schedule of actions, with roles and responsibilities can ensure positive engagement and involvement by all parties.</p>
<p>Matrix management systems are often vulnerable to constant changes. Did you see a matrix management develop at the schools? If not, what other management system(s) evolved?</p>	<p>They established a project management team and a steering committee (representatives of all stakeholders). The management of project scope, quality, time and human resources is done through a system of daily communication between schools and the quarterly planning sessions. A simple monitoring tool was designed and implemented to determine progress and opinions. What he very strongly emphasized in meetings with the school-based project management teams is to ensure one line of communication and reporting in and one line of out.</p>
<p>Who is responsible for monitoring the performance of educators involved in the project?</p>	<p>Principals and HODs of each school. This cannot be done by outsiders.</p>
<p>Did the SGBs play a significant role? Elaborate.</p>	<p>They listen to concerns and address it; all SGBs were very involved from the beginning and supportive. They understand their importance to sustain the project.</p>
<p>If you think of the other different role players in the project, how would you describe their influence on the project?</p>	<p>Learners and teachers, they are the engine of the project; If they do not own the project a big disaster, sponsors – without them no project; they provide the diesel for the project; school principal forum – they are the mechanics of the project, they help fixing and service the engine; they steer the project.</p>